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A COMPARATIVE AND EXPERIMENTAL APPLICATION
OF THE PSYCHOLOGY OF SET

by

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A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled, "A Comparative and Experimental Application of the Psychology of Set," submitted by John Hritzuk in partial fulfillment of the requirements for the Degree of Doctor of Philosophy.

ABSTRACT

The primary purpose of this study is a comparison of a Soviet approach to set, the contribution of D. N. Uznadze and his co-workers and students, with the contributions of Western psychologists to set, such as Young, Freeman, Dashiell, F. Allport, Postman, Bruner, Helson and Luchins. A secondary purpose of the study is the empirical investigations of the relationship between temperament as conceived by Norakidze, a student of Uznadze, and by Eysenck.

Uznadze defines set as the state of the subject in which prior events or activity conditions an individual to perceive stimuli or to react to stimuli in a specific manner. A set arises in the presence of a need, basic perception, and a situation to satisfy the need. Repetition of the same need and approximate situation results in a fixed set. For Uznadze there is functional equivalence between the unconscious and fixed sets. Behavior, however, is not always determined by fixed sets; man is capable of cognitively reassembling the circumstances and of developing a new set to redirect his activities.

For American psychologists set has varied meanings. Young describes set as biological in nature; Dashiell, as a predisposition; Freeman, as a covert tension in the skeletal muscles; Allport, as conscious or unconscious states; Postman and Bruner, as hypotheses; Helson, as one aspect of adaptation level; and Luchins, as habituation in problem-solving.

Some American views on the nature of set that compare with those of Uznadze are: sets are unconscious, sets may be stored by an individual for later use, and sets may be formed through the instrumentality of language. However, Uznadze emphasizes that set is basic to all behavior.

The work of Helson and Luchins differs from that of Uznadze. Helson emphasizes that organisms establish an adaptation level that is a weighted mean of focal, background and residual stimuli. By quantitative means it is possible to predict responses. Uznadze does not emphasize the role of stimuli; a set arises in the presence of a need and a situation. Luchins' concept of the Einstellung Effect is not basic to all activity and in this respect differs from Uznadze's emphasis of set.

The writer compares in detail the views of Norakidze and Eysenck. On the basis of a comparison between the views held by Eysenck and Norakidze, the major hypotheses predicted that the hysterics, as compared with the dysthymics, require fewer trials to fixate, more trials to extinguish, and irradiate a set. The minor hypotheses predicted that neurotics and extraverts, compared with stable individuals and introverts, require more trials for set fixation and extinction.

One hundred and fifty-eight female subjects completed the Eysenck Personality Inventory. Subsequently, subjects obtaining high scores on the neuroticism-stable and introversion-extraversion dimensions, as well as the hysteric and dysthymic categories as defined by Eysenck were given set tests in the haptic and visual modalities. The Kolmogorov-Smirnov test was used in the statistical analysis. The results support one of the major hypotheses namely that hysterics compared with dysthymics require fewer trials to fixate a set. However, extinction set trials in the haptic modality do not differentiate the two groups. Since dysthymics do not fixate a set in the visual modality, extinction comparisons are not possible. The results do not support the minor hypotheses that neurotics and stable individuals as well as the introverts and extraverts differ in the number of trials required to fixate or extinguish a set.

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CHAPTER I

INTRODUCTION

The literature on set is characterized by lack of clarity. Even though the term has been used by psychologists for more than seventy years, their comments in the literature indicate that research in the area is incomplete (Gibson, 1941; Luchins, 1966). The following comment emphasizes this problem area:

. . . most of the significant psychologists are demonstrating that each person's pattern of adjustment carries with it characteristic 'sets'; there is an effort to investigate more thoroughly the organizing role of 'set' which has been left essentially unexplained (Witkin, 1954, 496).

Dashiell (1940) refers to set as the neglected fourth dimension to psychological research, the other three being present stimulus situation, previous experience and genetic factors.

Hebb notes that set and attention are not anthropomorphic, animistic or undefinable terms. He adds, ". . . since everyone knows that attention and set exist, we had better get the skeleton out of the closet and see what can be done with it (Hebb, 1949, 5)."

It is possible that better understanding of set would result from the examination of contributions of psychologists working in a milieu different from the Western. Various definitions of the concept of set adopted by Western psychologists (Allport, 1955; Gibson, 1941) in areas such as learning, perception and personality, make no reference to ideas presented by Georgian psychologists. The psychological literature devoted to the study of set by D. N. Uznadze and his co-workers in Tbilisi, U.S.S.R., has not been utilized in the past by Western readers,

even though some of his works were published in German as early as 1924 (Uznadze, 1924). However, during the past few years one of the major works of Uznadze (1958) has been translated from the native Georgian language into the Russian language. Also, several publications on set by Soviet psychologists have appeared in English psychological literature (Bzhalava, 1961; Natadze, 1960, 1962; Yakushev, 1966). Uznadze's The Experimental Basis of the Psychology of Set (1961) has been translated into English (Uznadze, 1966).

Because research on set in the Soviet Union and in the Western world has not been compared and integrated, it is the writer's plan in this study to:

1. describe the theoretical and experimental aspects of set as developed by Uznadze over a thirty year period;
2. examine some contributions to the study of set made by several Western psychologists, such as Allport, Bruner, Dashiell, Freeman, Hebb, Helson, Luchins and Postman;
3. compare the views held by Uznadze with those of selected Western psychologists, namely Helson and Luchins;
4. examine the procedure used by Uznadze for set testing (Uznadze, 1958, 1961) and study experimentally the performance on the Uznadze set tasks of groups of subjects differentiated on the Eysenck Personality Inventory (1963).

Value of the Study

Eysenck notes the value of studies which deal with contributions from Soviet psychology:

A last characteristic of the Russian work is its almost complete disregard of Western work; in this we have perfect reciprocity, as Russian work is practically never mentioned in the West. On this point one can say, "A plague on both your houses!" It is clear that science does not stop on one side of the Iron Curtain, and whatever may be true of the feelings the Russians have about our work, it would certainly be extremely foolish of us to disregard the very important advances that Teplov, Luria and others have made in recent years (Eysenck, in Gray, 1964, ix).

The rate of progress of psychological exchange is not rapid, due to barriers such as the lack of translations of Soviet psychological

works in the West and the lack of competency in Russian among Western researchers. However, conferences such as the XVIII International Congress of Psychology held in Moscow in 1966 promote exchange and understanding of psychological contributions.

It is possible to advance another reason for the gradually developing interest in Soviet psychology. The rapid progress made by Soviet scientists after World War II has been noted by people throughout the world. Rapid advances in education have been of special interest to Western educators, especially after the launching of the Russian Sputnik. The impact was felt almost immediately by educators and psychologists in Canada and the United States who wanted to change Western educational practices.

In reading translations of psychological works from Russian to English, there is a possibility that terms do not have equivalent meanings. For example, the term "mental action" appears in Soviet psychological translations, but it is difficult for the reader to understand the true meaning when the term is removed from the Russian context. It appears that one could use a term very freely, and interpret it in his own way, without really knowing what the original author meant by the word. The writer is of the opinion that it is essential to check Russian psychological terms for equivalence before they are used in Western psychological contexts. To illustrate, in the translation of Pavlovian psychology, the term "conditioned reflex" has been used widely in Western psychological literature. The term as used in Western literature has a very precise meaning in stimulus-response theory. Gantt (1959) uses the term "conditional reflex," which is the more correct translation for the Russian uslovnye, the word Pavlov used. This translation takes into account the general stimulus field rather

than a specific stimulus. Thus it may be possible, by closer examination of the Georgian and Western views on set, that some clarification of the phenomenon can be expected, with a clarification of the usage of terms. For example, there may be some danger in using English terms, such as "extravert" or "impulsive," without first checking their equivalence with Georgian terms.

Procedure and Organization

The writer proceeded to implement the study in the following manner:

1. The available works of Uznadze on set were read, namely "The Investigation of the Psychology of Set" in Acta Psychologica (1939) written in the German language, but made available to the writer in English, Eksperimental'nye Issledovaniia po Psikhologii Ustanovki (Experimental Investigations in the Psychology of Set, (1958), Eksperimental'nye Osnovy Psikhologii Ustanovki (Experimental Basis of the Psychology of Set, 1961) and Psikhologicheskie Issledovaniia (Psychological Investigations, 1966), and The Psychology of Set (1966), a translation from Russian into the English language of Uznadze (1961).
2. The contributions to set appearing in Voprosy Psikhologii (Problems of Psychology) from 1955 to 1967 were read, namely Adamashvili (1960), Bochorishvili (1963, 1966), Bzhalava (1958, 1961, 1962, 1967), Chkhartishvili (1958, 1963, 1964, 1966), Eliava (1961), Filatov (1965), Khodzhava (1961), Natadze (1957, 1958, 1960, 1961, 1962), Prangishvili (1955, 1961), Ratanova (1962, 1963), Shevarev (1962), Troshenok (1961) and Yakushev (1965).
3. Contributions to set by several North American psychologists were read, namely Allport (1955), Bruner (1951), Dashiell (1949), Freeman (1939), Hebb (1949, 1955, 1958), Postman (1951), Woodworth (1937, 1947, 1954) and Young (1925). The major works of Helson (1951, 1959, 1964) and Luchins (1942, 1966) were used for comparative purposes at a theoretical level.
4. The works of Eysenck (1949, 1953, 1955, 1959) and Norakidze (1958, 1966) were examined for their contributions to personality. The contributions of each are used for the empirical part of the study.

The following organization has been adopted in the study:

1. a discussion of Uznadze's theory of set, Western views on set and some comparisons of Western and Georgian views on set;

2. an experimental application of set.

Included in the first part of the study are Uznadze's views on set and personality, views on set by several Western psychologists, and a brief comparison of Helson's adaptation level and Luchin's Einstellung with Uznadze's formulation of set. Thus the first part provides the reader with an opportunity to become familiar with Uznadze's theory of set and to note how it differs from the concepts held by Western psychologists.

The second part, the experimental portion of the study, begins with a review of Eysenck's and Norakidze's research in personality. The Eysenck Personality Inventory (E.P.I.) is used to select subjects on several dimensions for performance on Uznadze set tasks. Comparisons are made between hysterics and dysthymics, between neurotics and stable and between the introverts and the extraverts on the numbers of trials required for set excitability, set extinction and set irradiation. The rationale for this part of the study is:

1. to check the similarity of meaning of several Western and Georgian psychological terms;
2. to observe the performance of subjects on Uznadze set tasks and compare their set characteristics.

In summary, the general outline is:

- Chapter I: Introduction
- Chapter II: Uznadze theory of set and personality
- Chapter III: Set from a Western point of view: a comparison with Uznadze's concept
- Chapter IV: An experimental application of set: the works of Eysenck and Norakidze
- Chapter V: Discussion and conclusion

To the writer's knowledge, there has been no North American experimental study and application of set as described by both Uznadze and Norakidze. Psychology as a science of behavior can profit from this study because behavior involves activity and set is conceived as the basis for all activity. A knowledge of set theory and set properties can throw

light on human behavior and permit one to examine activity from a fresh point of view. One might also go a step further and relate set to nervous system properties.

If one is interested in improving the educational process and if one thinks of education as the formation of appropriate sets, then set theory becomes an invaluable addition to the structure of psychology and education.

CHAPTER II

UZNADZE'S THEORY OF SET AND PERSONALITY

I. BIOGRAPHY

Dmitri Nikolaivich Uznadze (1886-1950) was born in the village of Sakara near Tbilisi in Georgia, republic of the U.S.S.R. At the age of ten he began attending classes at a local school and graduated from secondary school in 1905. Uznadze continued his education at Leipzig University under Wundt and Barth and obtained his doctorate from there in 1909.

In 1910 Uznadze returned to his village where he became active in pedagogical activities. In 1915 he established the first secondary school for girls in the area. In 1917 Uznadze moved to Tbilisi where he became involved in educational reforms and writing.

In 1918 Uznadze established and became head of the Psychology Department at the University in Tbilisi. In the experimental laboratories he investigated many of his basic ideas. In 1941 he became head of the newly established Research Institute of Psychology within the Academy of Sciences of the Georgian S.S.R.

Although Uznadze investigated speech, concept formation and memory, his greatest contribution was to the psychology of set. Forty years of his life were devoted to teaching, experimenting and writing. Some of his major contributions include the following: Experimental Pedagogy (1912), "Impersonalia" (1923), Fundamentals of Experimental Psychology (1925), Data Concerning the Psychology of Set (1933), The Psychology of Set (1938), "Understanding the Psychology of Einstellung" (1939), General Psychology

(1940), Child Psychology (1947) and The Experimental Basis of the Psychology of Set (1949). He continued to write until his death.

A number of Uznadze's pupils, for example A.A. Prangishvili, R.G. Natadze, and V.G. Norakidze, continue to investigate the phenomenon of set at the D.N. Uznadze Institute of Psychology of the Academy of Sciences of the Georgian S.S.R. in Tbilisi. His students organized a special symposium on set for the XVIII International Congress of Psychology held in Moscow in 1966.

II. THE GENERAL THEORY OF SET

Uznadze, as early as 1923, became interested in the experimental work of Fechner, Müller and Schumann, who wrote at different periods of time (Uznadze, 1939, 323-330). They found that when a subject is instructed to successively lift a pair of objects differing in weight, he will later perceive two equal weighted objects as unequal. The object in the hand which previously held the lighter object will seem heavier than the object in the other hand. Uznadze calls the results examples of illusions of weight (Uznadze, 1961, 13).

Uznadze was also interested in the work of Watt and Ach. Watt experimentally investigated the role of task set in thinking. A subject was first presented verbally with a task and then, after a short time interval, with a word stimulus. The subject gave a response to the stimulus and an introspective report of his experience. Watt concluded that the task set or Aufgabe influenced the response. He further noted that set was effective when the subject was aware of getting ready, practiced the task and responded correctly (Humphrey, 1951, 115).

Ach was also interested in Aufgabe. He noted that a task leads to an Einstellung or set which acts as a determining tendency. That is, the task establishes a set in the individual which in turn determines the nature of the response (Ach, 1951, 20).

Uznadze continued to investigate Einstellung and illusion. He adds:

. . . the concept of relative set--was one I formulated twenty-five years ago . . . from that time until the present, this idea has been continuously and logically developed. Progress became particularly rapid after my pupils and colleagues began to take part in its development. (Uznadze, 1966, vi).

The sections which follow deal with Uznadze's formulations of set.

A Viewpoint of Modern Psychology

Psychology as a science of the mind is limited to the investigation of the traditional concepts of mental activity such as cognition, sensation and volition. Psychologists, according to Uznadze, continue to restrict their studies mainly to the mental processes (Uznadze, 1966, 198). He adds:

. . . Starting with Aristotle, progress in psychology has consistently been the result of investigation of these states, and even in the most recent stages of its development, in the experimental investigation of mental processes, there have been no advances made beyond these usual frontiers of the investigation of the mind (Uznadze, 1966, 198).

Uznadze (1966, 198) further adds, "The study of the processes of mental life, such as cognition, will and sensation, has often taken the wrong approach." Active interrelationship of mental activity with the environment is not one of man's functions; the active participant in the environment is man himself. It is the subject himself and not the individual acts of his mind that take part in man's active relationships with the outside world. Psychology as a science must start with the subject as a whole, who, when taking part in some form of interaction

with the outside world, requires the participation of cognitive processes. The study of human activity is the task confronting psychology, for it is on the basis of activity that the whole superstructure of our mental function arises. Psychology must examine what the activity is and which of its elements may be revealed and investigated by experimental methods. Therefore, psychology must investigate the subject as a whole and not the individual elements of his mental activity (Uznadze, 1966, 200).

Set as a Factor in Activity

Uznadze (1961, 29-32) describes set as the phenomenon in which prior events or activity conditions a subject to perceive or react to stimuli which follow in a particular manner. Furthermore, the behavior of a living being presupposes the following conditions: a need, a situation, and a basic level of perception (Uznadze, 1961, 165-179).

Prangishvili adds:

Thus set--since it is seen to be, essentially, in the nature of disposition to a definite form of response, which implies a definite form of psychological organization of the subjects "inner milieu"--may justifiably be regarded as the general characteristic of the subject's integrate state, i.e., of his personality and not of the fixity or rigidity of his behavior. . . . This pre-orientedness (as evinced in set) toward a definite activity is obviously--since preparedness for response is an integral part of activity--to be seen as manifestation of his oneness of activity and personality. . . . Set is not primarily the "resultant of behavior," but the precondition of the very feasibility of purposeful adaptive behavior. It is set--underlying as it does and triggering emergent activity--that constitutes the psychological content of the interaction of the two determinants of behavior: a concrete need and a situation for its gratification (Prangishvili, 1966, 50-51).

The model of behavior that Uznadze presents is that of a dynamic relationship between the individual and his environment. In this, Uznadze's set is similar to Piaget's concept of adaptation which involves

the cycle between accommodation to the environment and assimilation of the environment to an internal schema (Bzhalava, 1965, 77).

Uznadze defines needs as all states of the psychophysical organism which are concerned with the changing of the environment, providing impulses indispensable for the aim of activity (Uznadze, 1961, 29). His concept of need is similar to that of Pribram (1964), Skinner (1953), and White (1959), who think of individuals as having a need to act on the environment.

There are two basic types of needs, the substantial needs and the functional needs (Uznadze, 1961). The substantial needs are synonymous with the viscerogenic needs or drives and the functional needs refer to the neurogenic motives as studied by Berlyne (1960), Bruner (1966), Hebb (1955), and White (1959). Uznadze (1961, 31) also refers to one additional class of needs, the cognitive needs; these he considers to be elaborations of the substantial needs or drives.

Uznadze (1961) explicitly states that the substantial needs are not the sole or the most important source of motivation, except in the very young organism. He states that the functional and theoretical needs are more characteristic of human motivation. This position is similar to that of Allport who states:

If biological drive plays a part (thirst, hunger, sex), it does so not as the motive but merely as an irritable state of bodily tissues set within an intricate and personalized psychophysical system (Allport, 1961, 251).

As for the functional needs, Uznadze views man as a continuously active organism who is curious about his environment and engages in activity for its own sake. Uznadze (1961) conceives of the functional needs as a set to activity which has arisen during the course of

phylogenetic evolution and which is characteristic of the higher primates. The biological significance of motivation is also stressed by White (1959). A similar position with regard to motivation has received support in recent Western literature (Berlyne, 1960; Harlow, 1953; Hebb, 1949; Pribram, 1964).

Man also lives in a socio-historico-cultural context. In his search for satisfaction of his substantial needs, man, in his interaction with others, often is confronted with situations in which his needs are unsatisfied. In problem situations such as these he is faced then with the question of what to do and how to do it in order to satisfy his needs. He must bring into consciousness the situation which has provided the problem; this is the process of objectivization. At this elementary level cognitive needs emerge. As the organism develops and internalizes more of his environment, including culture, the intellectual or problem-solving attitude becomes established in its own right and forms the basis of interest in theoretical problems which have no immediate reference to reality (Uznadze, 1961). The formulation has some features similar to Allport's functional autonomy (Allport, 1961).

Set, although an internal condition requisite for the development of mental phenomena, is itself a factor which arises out of the interaction of the individual with his environment. Because of the importance of environment, Uznadze also emphasizes the importance of the second basic condition for the emergence of activity, that of the situation (Uznadze, 1961).

The Problem of Objectivization

Uznadze distinguishes two possible levels of human behavior (Uznadze, 1958, 77). The first plane is the level of impulsive actions

in which man is stimulus bound, responding directly to a given situation. The second plane of behavior gives man increasing independence of response from the immediate nature of the stimulus. This level of intellectual behavior is associated with the phenomenon of objectivization (Uznadze, 1958). The first plane is characteristic of all animals and might be associated with Pavlov's first signal system; the second plane, which might be associated with Pavlov's second signal system, is peculiar to man whereby behavior becomes regulated by man's cognitive structure.

Uznadze's view may be examined in relation to Soviet psychology and philosophy. According to the tenets of dialectical materialism the mind or psikhika is a function of highly organized matter, in this case, of the brain. This organization consists of the reflections of objective reality in the form of sensations, ideas, thought, and the like; the reflection constitutes the subjective world of man (Shorokhova, 1966, 201-210). In Uznadze's theory it is through the act of objectivization that the subjective world of man or his model of reality comes to approximate more and more objective reality. In essence, then, objectivization is concerned with the successive approximations of the subjective representation to objective reality. This implies that there are degrees of consciousness. The more accurate the subjective model of reality and the wider the scope of reflection of reality, the greater is the degree of consciousness.

The plane of intellectual behavior established through objectivization develops out of the first plane. In the first plane, set in man responds directly to his environment. Whenever there is a disruption in the activity of this kind of set, a problem situation emerges which

forces the individual to attend to the situation. In other words, when set realization is retarded, the individual becomes aware of the retardation in the flow of behavior and turns to the act of objectivization. As Uznadze (1966, 132) says, there emerge the questions, "What is this?" "Why is this so?" "What would happen if things were different?" With the emergence of the problem comes also an imagined situation to solve it, the result of which is the appearance of a definite set. "Every separate act of thought arises from the base of this set and represents a separate case of its realization (Uznadze, 1961, 107)." Consequently, thought flows on the basis of objectivization in which set plays an important role. Through the development of cognitions by means of objectivization, there emerges a new stratum of set in man which determines and defines his behavior. Since objectivization is accomplished by use of language and since a word represents a specific sphere of reality, words become a powerful tool in defining man's subjective representation of reality (Luria, 1961; Uznadze, 1961; Vygotsky, 1962). Vygotsky (1962, 18) has pointed out that a word is a microcosm of human consciousness; this places great importance on words in man's existence. Consequently, by means of language man can imagine problem situations, possible solutions and develop a definite set to activity without recourse to reality. Through objectivization man is capable of logical calculus, of performing operations upon operations (Piaget, 1950, 10-45), and thereby organizing his knowledge of reality (Ausubel, 1965, 103-115).

Further Examination of Set

Uznadze (1958) states that in the development of the individual, set is established initially through kinesthetic feedback, especially of the motor manipulatory kind. Manipulation as the initial basis for the

emergence of set reinforces the importance of grasping in the evolution of the species (Bruner, 1966; Marx, 1961; Vygotsky, 1962; White, 1959) and in the evolution of the individual (Bruner, 1966; Luria, 1961; Vygotsky, 1962; White, 1959). Manipulatory behavior in ontogenesis is a fundamental postulate in Piaget's theory, in which the cognitive structure is an extension of motor action (Maier, 1965; Piaget, 1950). Bzhalava states that in the later development of the organism vision and audition become the dominant modalities whereby the individual establishes his relationship with reality (Bzhalava, 1965, 55-80).

In any given situation the individual usually possesses a functional readiness to respond. That is to say, the individual responds as a whole with a characteristic degree of mobilization of the central nervous system. This mobilization is his set, his readiness to activity as a unity (Teplov, 1962). Whenever the individual responds he internalizes part of his environment in accordance with his characteristic set or degree of mobilization and thereby forming the basis for his representation of reality (Bruner, 1966; Prangishvili, 1962; Uznadze, 1961). In Piagetian theory, the individual assimilates his environment to form internal schemata (Piaget, 1950). During his lifetime the individual forms many varied specific or fixated sets, each set reflecting the environment and need of the organism to different degrees, each providing the basis for activity in a definite direction. Depending upon the response readiness of the individual, the specific content will more or less approximate reality. Uznadze (1961) indicates that the greater the degree of readiness the more accurate will be the subjective representation of reality (objectivization).

It must be emphasized that it is the readiness of the total individual which pre-determines the mode of problem-solving in the form

of specific sets. Set is a psychic state preceding objectivization, not a variable which arises epiphenomenally in the course of learning as maintained by F.H. Allport, (1955); Dashiell, (1940); Gibson, (1941); Hebb, (1949); Mowrer, (1940).

In summary, set is

1. a psychological realm sui generis (Brozek, 1962, 551);
2. a phenomenon which does not represent a content of consciousness. It forms the basis for the emergence of consciousness in that set is a readiness for activity. In this manner the unconscious is seen as a positive concept as opposed to the negative character of the unconscious as posited by Freud. It is the modus of his condition as a whole (Uznadze, 1961);
3. the dynamic structural unit of the integral personality into which the activity of the organism is incorporated (Prangishvili, 1962, 182);
4. the basis for the emergence of all activity of the personality, such as perception, cognition, memory (Prangishvili, 1962, 183). The mechanism by which all human activities arise out of set is referred to as objectivization. Objectivization is defined as "an act enabling us to experience something as a particular object (Uznadze, 1966, 228)." Through objectivization man is able to reflect reality in his thought. However, it is emphasized that the reflection of the external reality (mir) is an active, not a passive, process. Man is actively interacting with his environment. His life is a flow of concrete activities, varying in their character, direction, content, and the distinctive ways in which the activities are carried out (Brozek, 1962, 553). In this interaction of the individual with his environment the psychological content of the set becomes modified;
5. the mechanism by which all behavior is organized and integrated.

Will

In a volitional act the individual is faced with the problem of putting into practice what he intellectually recognizes as being worthwhile (Uznadze, 1966, 135). The problem is essentially the ability to put into action a set corresponding to an act of behavior that has become cognitively necessary. The appearance of such a set is sufficient to ensure the performance of the act. Will makes it possible to switch to sets involving future goals, regardless of the impulsive sets elicited in the individual at the particular moment (Uznadze, 1966, 245).

In the plane of objectivization what has been discovered by acts of thought must be translated into activity; thought alone is not sufficient. The ability to translate thought into action depends upon the conditions of emotional-affective development (Norakidze, 1966; 33; Piaget, 1961). It follows that volition may involve conflict between intellect and emotion. If a conflict arises and emotion dominates, the impulsive set will determine behavior rather than the objectivated set. On the other hand, if intellect is stronger than emotion, sets will be activated at the second level of behavior (Norakidze, 1966).

Set and Perception

Perception in man involves the following two stages:

1. The first stage is the effect of the stimulus on one of the sensory organs, an effect which is not regarded as a true, complete perception of a definite stimulus. This is the stage of sensation (Uznadze, 1966, 207).
2. The participation of a set in a definite form is required for true perception. In the presence of a need, a situation for its satisfaction and the sensation of stimuli acting in this situation, one can say that the subject initiates his activity as an integral, living organism. In order to do this, one must develop a set corresponding to this activity; one must develop a set toward the perception. Thus the complete, true perception must be regarded as the second stage in the development of the perceptual power of the living being (Uznadze, 1958, 93; 1966, 207).

Methods of Set Experimentation

The basic method for the investigation of a fixed set consists in the following. A subject develops a need to solve an experimental problem presented to him, for example, to indicate which of two spheres given to him appears larger. Two spheres of equal weight but of unequal size are presented for short periods to the blindfolded subject. The spheres are placed one in each hand for a brief moment, that is, the larger sphere in the right hand and the smaller sphere in the left hand.

The first exposure to the unequal objects, called the set tests, results in a set arising in each case, a set to the evaluation of a "larger" or a "smaller" sphere. Following these set tests, say in the eleventh trial, the unequal spheres are replaced by two equal spheres and the subject is asked to identify them. This test is designated the critical test. The critical test discloses the presence of a fixed set developed in accordance with the preceding set tests since the subject evaluates one of the two spheres of equal size as "larger" or "smaller." The test reveals the presence of a preparation for a definite activity, that is, a set (Uznadze, 1958, 34).

In the critical tests a subject may experience two types of illusions, contrast and assimilative. For example, a contrast illusion results when during the critical tests with the equal spheres, the sphere is perceived as smaller in the hand in which, during the set trials, the larger sphere was placed. If, however, the sphere is perceived as larger, an assimilative illusion has developed. The ease with which an illusion is formed is known as the excitability of set (Uznadze, 1958, 14).

Fixed and Diffuse Sets

According to Uznadze (1966, 40), the decisive factor in the formation of fixed sets is the repetition of identical situations. When an individual meets a similar situation at some later time, the fixed set rather than a new set enables one to react in a specific manner. Once a set is activated, it does not disappear but remains ready to be activated when similar conditions arise. However, the state of preparedness is not always the same; the more firmly the set is fixed, the stronger will be its power of activation.

Diffuse sets are usually formed in the initial stages of set development. When a set is produced for the first time, it is in a comparatively undifferentiated, unindividualized state. To become differentiated, repeated presentation of appropriate stimuli are necessary; therefore, set fixation also involves degrees of differentiation (Uznadze, 1958, 30-33).

Irradiation

Set is an integral state of the individual; a set developed in one modality during the course of the set tests manifests itself in other modalities. Uznadze was able to show that set transposes from one organ to another, as well as from one sense modality to another (Uznadze, 1958, 20-24).

In an experiment with 40 subjects, Uznadze (1961) presented a set test in one hand and the critical test in the other hand. An illusion was observed in 83.5% of the cases. Similarly, when set tests were conducted in one eye with critical tests conducted in the other eye, an illusion took place in 76% of the cases. Subjects were asked to feel two unequal spheres of the same weight but at the same time were shown two equal circles in a tachistoscope. About 56% of the subjects perceived the two equal circles as unequal. The results were similar when subjects were shown two unequal circles in the tachistoscope and were asked to compare two equal spheres in their hands. Experimental results proved that set irradiation from one modality to another supported the proposition of the integral nature of set as the base of the perceptual illusions (Uznadze, 1958, 24).

The Phasic Nature of Fixed Set Extinction

Set has a phasic nature in its transition from a fixed state to a stage of veridical perception. For example, if two equal spheres are perceived as unequal by a subject, the spheres are repeatedly presented until they are perceived as equal. As a result, one notes that the perception of the critical objects usually passes through three main phases. The first phase is the contrast illusion, where the sphere is perceived as larger in the hand which contained the smaller sphere in the set tests. The second phase still contains a number of contrast illusions but the majority are mainly assimilative illusions. In assimilative illusions the sphere is perceived as larger in the hand which contained the large sphere in the set tests. In the third phase, the number of illusions slowly decreases until a veridical perception is reached.

Differential Psychology of Set

Uznadze notes there are several individual differences in set (Uznadze, 1961, 69-82).

1. Individuals differ considerably with regard to the ease of exciting a fixed set. In some, fixed set may arise after one or two setting exposures; in others, set only develops after ten or fifteen setting exposures. In some, fixation does not occur.

2. Fixed set can be static or dynamic in nature; the terms refer to the extinction of set. Individuals with a static set, even after fifty exposures of the critical tests, do not pass through all the set phases; they are unable to reach veridical perception. The individual "freezes" at one phase but not necessarily at the first one. People with a dynamic set, while under the influence of the critical tests, are able to reach veridical perception during the course of the experiment; that is, they

pass through the various phases of set manifestation.

3. Regardless of the static-dynamic properties, a set also may be characterized as plastic or rigid. Plasticity manifests itself as the gradual, smooth transition from one phase to another. A dynamic set may be plastic if the test subject gradually passes through all the phases of extinction prior to a veridical perception. A static set will be plastic when, before remaining at one phase, it gradually passes through all the preceding phases. A rigid set skips the assimilative phase; for example, the set passes directly from the contrast phase to a veridical perception.

4. Irradiation is the transfer of a set from one modality to another. In Uznadze's words, "Set is a psychological fact which has as one of its features the fact that it irradiates throughout the organism as a whole (Uznadze, 1966, 82)." If set irradiates poorly, it is known as "local set," while at the other extreme it is designated as strongly irradiated set.

5. Generalization of set refers to the response an individual makes to objects other than those used in fixating the set. For example, spheres used in set tests may generalize to ellipses used in the critical tests.

6. There are degrees of constancy and degrees of variability of set. If one conducts set tests at different times on the same individual and if the same type of set manifests itself, then the set is constant. On the other hand, a test subject with a variable set does not exhibit the same set through a period of time.

7. Set varies in degrees of stability and lability. A constantly stable set is preserved for a long time and remains unchanged in form.

A variable-stable set is preserved for a long time but changes form.

A labile set can also manifest itself in two forms. If the labile set remains unchanged prior to fading, it is called a constant-labile set; it is termed a variable-labile set if it undergoes change prior to fading.

8. Individuals differ with respect to the number of extinction trials they undergo to achieve veridical perception. In some, set illusions extend only to two or three critical exposures. In others, set illusion extends to over fifty critical exposures, resulting in almost an "infinite illusion."

III. THE STRUCTURE OF PERSONALITY

A general postulate underlying the theory of set in both general psychology and personality is given by Prangishvili.

Insofar as the personality, in its unity and wholeness cannot be reduced to a simple conglomerate of individual psychic processes, psychic properties and separate actions, and insofar as the concept of the subject of activity (personality) can neither be divorced from this concept nor be identified with this concept, therefore, according to the views held by D. N. Uznadze, the investigation of the concept of personality as an initial concept should be understood in the first place as a study . . . of that absolutely real sphere of the psychic, which is the personality (subject of activity), precisely as a unity and an integral whole irreducible to specific psychic processes (Prangishvili, 1962, 181-182).

Prangishvili further notes that in psychological science personality is often described as an arbitrary concept. It is deduced from the concept of human mental activity but at the same time is proclaimed as the origin and basis of human mental life. The problem of personality is often considered in general psychology only after the phenomena of mental life have been fully discussed and opportunity is available for describing the concept of personality in terms of these phenomena (Uznadze, 1966, 22).

For Uznadze, personality is a comprehensive concept; it implies phenomenological, biological and psychological dimensions. Personality also implies a conscious, social individual who determines the historical and social environment he inhabits. In line with this, personality should be considered the subject matter of sociology, psychology and philosophy (Uznadze, 1958, 1961).

The Nature of Personality

Uznadze's interest is in the living man and in his relationship with the environment (Uznadze, 1958, 1961). The view is similar to several Western personality theorists (Goldstein, 1939; Kelly, 1963; Murphy, 1947). To understand psychological activity, psychology must first understand the subject of activity, the personality (Angyal, 1941; Rogers, 1951; Uznadze, 1961). Understanding the regularities of the structure and the function of the mind would be impossible if one studied the individual activities separately, which together constitute the whole personality. Since personality is a factor which is present in all acts of relationship of the subject with reality and in all specific processes, the problem of the whole personality ought to be considered as the initial problem of scientific psychology (Uznadze, 1958, 1961).

For Uznadze, personality is conceived as a subject who interacts with the environment, whose activities are initiated and directed through the mediation of the set of the individual. Set precedes all activity and determines the kind and degree of incorporation of specific, conscious content. In this way, the concept of personality is seen as a basic concept.

Wholeness is a new quantity distinct from the sum of its parts; integrity is irreducible to the characteristics and regularities of the parts (Köhler, 1947; Uznadze, 1958). Man is not the sum of physical and mental elements but is a reality that relates as a whole to the environment. The individual is an existing, integral personality, the carrier of the mind which emerges as the means for intercourse with the external world. Personality is present in every given moment as the subject of activity. Since activity is dependent upon set, the structure of set is the basic structure of human behavior. Therefore, a study of personality involves the study of set (Norakidze, 1966; Uznadze, 1961).

As previously mentioned, objectivization gives rise to sets which determine the participation of higher mental processes. The structure of sets reflects the total structure of the active personality as the subject of behavior. The dynamic structure of behavior is evident in mental acts of every individual (Allport, 1957; Harvey, Hunt and Schroeder, 1961; Uznadze, 1961).

The properties of personality which determine behavior also determine individual typological features. The structure of internal and external behavior of personality is characterized by psychological regularities of set and typological distinctiveness. Therefore, the concept of set clarifies the structure of personality (Norakidze, 1966, 15).

The Problem of the Unconscious

According to Uznadze (1966, 38), the weakest point in Freud's theory of the unconscious is the assertion that the conscious and the unconscious processes are fundamentally identical. Freud considers that man's mental life is largely based on processes taking place in the unconscious. For him, everything depends on the patient's past experiences.

Experiences that might have been conscious were in the first instance repressed (Freud, 1949). It seems as though forgotten elements of consciousness continue to live and act outside consciousness and thus exert their influence on the subject's behavior.

According to Uznadze, Freud's idea of the nature of the unconscious is a negative concept because it is simply a mental state lacking consciousness. The unconscious is never a stage in the development of the mind, preceding and preparing for the appearance of conscious mental experiences. Except for this attribute, the conscious and the unconscious are identical phenomena (Uznadze, 1961, 177).

For Uznadze, the unconscious as a positive concept precedes the appearance of the conscious mind. The stage of development preceding consciousness is that of set fixing. Therefore, the unconscious actually exists in us but this unconscious is none other than our set (Uznadze, 1966, 214).

The Nature of Personality Traits

According to Norakidze traits imply comparatively stable forms of attitudes that man has towards himself and the environment (Norakidze, 1966, 33). The form of the attitude is specific to the individual and the kind of social relations (Allport, 1950; Norakidze, 1966; Reisman, 1961). Traits, like abilities, become fixated in the individual and appear on the impulsive level of human behavior (Norakidze, 1966, 37).

Outside of the peripheral, biological theories, there has been little search within physiology to find the bases of traits in the nervous system (Norakidze, 1966, 31). People with different types of nervous systems and constitutions are capable of being good or bad, social or asocial, etc. Since physiological theory has been unable to explain the origin of traits, the concept of

set has greater importance (Norakidze, 1966).

It is reasonable to assume that enduring sets may become fixated in the personality on the basis of individual needs and the corresponding environment. During a lifetime many fixated sets develop and among them are sets which have a significant role or purpose in personality. Because of the importance of these sets and their concomitant dispositions, the sets may excite easily and emerge in the transaction of the personality with the environment. To a large extent the sets will determine the direction of individual features of personality. Needs and fixated sets of the personality are the basic motivation of all behavior. Thus motivation is the basis for the development of the individual and his traits (Norakidze, 1966, 31).

Temperament

Uznadze notes that certain features of personality pose difficulty for explanation in terms of set theory. These features are closely related to the problem of innateness, such as temperament and capabilities. Temperament is a component of behavior concerned with the emotional-affective aspects and like the factors involved in the dynamics of experience, it is controlled in its expression by the regularities of set (Norakidze, 1966, 34).

Temperament represents a dynamic aspect of needs. The expression of temperament is regulated by mental activities and forms an integral part of objectivization, thus influencing the type of set which develops. The involvement of temperament in set development results in various types of sets, such as weak, inert, dynamic or flexible. For example when amorphous needs are present, as in severely depressed individuals, set does not fixate. In hysteric people with weak, vacillating needs, set

is labile. Thus temperament is related to the regulation of the whole personality (Norakidze, 1966, 35).

In conclusion, emotional content is defined by the individual's features of temperament and directionality of emotional reactions (Allport, 1957; Norakidze, 1966). Temperament is concerned with the structure, dynamics, and content of emotional life. As a component of behavior and as a factor in the formation of set, temperament is involved in the establishment of the structure of personality (Norakidze, 1966; Uznadze, 1958).

Abilities

In Soviet psychology abilities are conceived as dispositions of the personality (Norakidze, 1966, 36). The origin of dispositions lies in the anatomical and physiological organization of the brain while the form is determined by the process of behavior. Practice gives direction to dispositions which are articulated in behavior. The abilities of the individual as expressed in action are involved in the structure of behavior; these specific abilities give distinctiveness to the structure (Murray, 1938). For example, Uznadze notes that artistic creativity is based not on special abilities of the individual but on features of the whole personality. The environment elicits a specific reaction in the personality which takes the form of a definite set, basic to subsequent activity. The difference in creativity between the artist and the average individual lies in the particular set reaction of the artist (Uznadze, 1961, 104-110).

Therefore, according to Uznadze, all activity of the personality, mental or otherwise, is realized through the structure of set. This structure includes the features of personality, such as traits, temperament and abilities.

The Nature of Character

The features of personality structure do not fully correspond with the structure of character (Allport, 1957; Eysenck, 1947; Norakidze, 1966). While the structure of personality has many manifestations, the origin of the interrelationship of mental life to the two levels of behavior is manifest most intensely in character. It is the basis of willed action and the central, significant sphere of the personality concerned with man as a social being. The character of personality leaves its peculiar imprint on the structure of activity. To investigate the origin of character, it is necessary to know the features of personality structure, the carrier of this character (Norakidze, 1966, 37).

Norakidze adds:

The origin of the two interrelated levels of man's psychic life and their specific features appear in man's character--the basis of willed acts, the central, significant sphere of personality in man as a social being. Character thus registers its features in the structure of activity (Norakidze, 1966, 43).

Such a concept means that to establish character types it is necessary to study the needs and the fixated sets of the personality.

Typology

Through experimental investigations of the psychology of set a number of general psychological and differential psychological indices have been established (Norakidze, 1966). As a premise it is necessary to realize that set involves a modification of the whole personality and this necessitates the learning of the general characteristics of sets.

Typology encompasses the extent and strength of fixated sets. The typological characteristics involve the major mechanisms of set and their direction. Individuals differ with regard to extinction, excitability, irradiation, locality, strength, stability and constancy of set. For

each individual the structure of personality exhibits individual-psychological features within a framework of the general regularities of set. Therefore, since type is based on set regularities, typology can be encompassed within the psychology of personality (Norakidze, 1966, 39).

Types

Through research, Prangishvili (1958, 1962) and Uznadze (1958, 1961) have demonstrated considerable individual differences in relation to properties of set, such as excitability, extinction and irradiation. In the initial experimental studies Uznadze identified several basic groups of adults mainly by their patterns of set extinction.

1. The first group includes people who have a static set. Subjects are so rigid they remain at the first phase of extinction; individuals do not reach the second phase, nor a stage of veridical perception.

2. The second group of people have a static-plastic set. During the course of a set experiment the test subject is unable to reach veridical perception. However, unlike the static group, test subjects are able to leave the first phase of extinction.

3. The third group of people are characterized by a plastic-dynamic set. Their set gradually passes through all the phases until a veridical perception is reached. The set is dynamic because it passes to a stage of veridical perception and plastic because it passes through all the phases of extinction.

4. The fourth group of people are characterized by a rigid-dynamic set. The set is rigid because it does not pass through all the phases of extinction, and dynamic because it passes to a stage of

veridical perception. For example, the test subjects may pass from the first to the third phase, completely omitting the second phase.

5. The fifth group includes people that are unable to fixate a set during the usual set tests; no illusion at any time is formed.

Uznadze refers to these people as extraverts (Uznadze, 1961, 128).

Uznadze (1961) in his final work on typology preferred to distinguish, from the point of view of set differences, three groups of human beings. The groups are as follows: the dynamic, the static and the variable groups.

The Dynamic Group

Set tests are conducted in the optic, haptic and kinesthetic modalities. In terms of excitability, dynamic people reach the optimum number of illusions after 15 fixing exposures. Thus set excitation is relatively low. Fixed sets in the majority of the subjects are plastic, dynamic and stable. Because of the characteristic dynamic nature of their sets, people in this group are referred to as "dynamic persons."

With regard to irradiation, 75% of the subjects transfer a set from the optic to the haptic sphere, but in most cases the irradiated set is weak. About 67% of the cases irradiate a set from the haptic to the visual modality. In general, although irradiation is fairly extensive, it usually remains comparatively low in intensity.

Investigations have shown that members of the dynamic group possess a well-developed power of objectivization. When a need for this power arises, it is transformed into an active state. In these cases the people do not encounter any considerable obstacles which they must overcome before acts of objectivization are put into operation. Therefore, the ability to change easily to objectivated purposes is a characteristic

feature of the dynamic group (Uznadze, 1958, 95).

The Static Group

With regard to speed of set fixation the majority of subjects require only two presentations of the experimental objects. Once fixated, the characteristic form of sets in all the sensory modalities tends to be static in nature. Sets are constant and stable in all cases; they also irradiate extensively from one modality to another. Uznadze concludes that the fixated sets of static people are highly excitable, coarse, static, intermodal and constant (Uznadze, 1958, 97).

If the activity of static people took place along the lines of their characteristic sets, most static types would exhibit schizophrenic behavior, namely because of their inability to attain veridical perception (Uznadze, 1966, 143). However, they give the impression that their activity takes place mainly under the vigilant control of their consciousness. On the basis of objectivization static people are capable of correcting their ongoing form of behavior through the formation of new sets. Because objectivization does not proceed smoothly, individuals endure strain when they choose and operate a set which corresponds to what appears desirable on the basis of their objectivization (Uznadze, 1958, 79).

The Variable Group

Uznadze distinguished two subgroups of the variable types, the variable-stable and the variable-labile groups (Uznadze, 1958, 98).

The variable-stable people are noted for their highly developed strength of needs. People in this group rarely show signs of set constancy; their sets vary from moment to moment. Set may be dynamic and

plastic but later appears plastic and static. At times sets are localized; at other times, widely irradiated. Another specific feature of the group is the stability of their varying sets. Subjects may react to a series of different phenomena with identical sets; they may also react to identical situations at different times with different sets. In addition, the individuals can readily carry out acts of objectivization. However, the volitional acts necessary to put the results of objectivization into practice do not develop with ease.

The variable-labile group, in contrast to the stable group, manifests a weakness of needs. The fixation of sets is mainly determined by the situation. Thus the external factor plays an important role in the sets of these people.

The course of fixed sets in the subjects varies; they may be weak, but sometimes strong, plastic and dynamic. In some cases sets may be rigid and localized or rigid and irradiated. The excitability of the sets varies from subject to subject, often with divergent results. Fixed sets often remain in force for about an hour but sometimes even less.

In summary, Table I, p. 33 shows the relationship between types of individuals and the main set characteristics. Uznadze does not give an exhaustive report of his typologies, thus some information is not available in the literature. For example, although generalization is a set property, Uznadze does not include the term in his description of types.

IV. CHARACTERISTIC RESEARCH AND RESEARCH METHODS

Research on personality conducted by Uznadze (1958, 1961) follows two basic procedures:

1. direct observation and interview with individuals. The basic

TABLE I SUMMARY OF SET CHARACTERISTICS AND TYPES

TYPE	SET CHARACTERISTICS						
	Excitation	Extinction	Irradiation	Stability	Constancy	Strength	Objectivization
Extravertive	No fixation of set		No set characteristics since set does not fixate				**
Dynamic	15 trials Low	Yes	Extensive but weak	Stable	Constant	Strong	Well-developed power
Plastic-dynamic	15 trials Low	Yes, reach veridical perception	**	**	**	**	**
Rigid-dynamic	10-15 trials Low	Yes, skips intermediate phase	Yes	Stable	Constant	Strong	**
Static	2 trials High	No, remain at phase 1	Extensive	Stable	Constant	Strong	Yes
Static-plastic	**	Leave phase 1 No veridical perception	**	**	**	**	**
Variable	Number of trials vary	Number of trials vary	Yes	Unstable	Not Constant	Varies	Yes, weak will
	Number of trials vary	Number of trials vary	Local, but may irradiate	Unstable	Not Constant	Varies	Rare, acts on impulse

** Information not available in literature

needs, modes of behavior, goals and relationship with other people are examined.

2. conducting set tests on each individual. The sets of the subjects are studied and individuals are grouped according to similar set characteristics.

Uznadze employed the typical procedures for the study of sets which are described in Appendix D. Various methods of studying set characteristics may be used, such as color, pressure, weight, volume and sound intensity. The most common method is the study of excitation, extinction and irradiation of set using spheres and circles in the haptic and visual modalities.

Set Fixation and Extinction of Quantity

Uznadze differentiates setting to quality and to quantity. Set developed to quantity includes responses to quantitative differences such as size, heaviness or brightness, while in quality work words and pictures are used for set study.

A subject is repeatedly presented for brief moments two unequal spheres of identical weight; he grasps them for a moment and replies which sphere feels larger or smaller. In the process, a set arises in the individual to assess the objects as bigger or smaller. The repeated presentation of spheres results in a fixed set. Following two or three presentations of the unequal spheres, two equal spheres are given to the subject. He grasps them momentarily and if they appear unequal, one assumes the subject has developed a fixed set; if they feel equal, the two unequal spheres are again presented.

For set extinction, the two equal spheres are momentarily presented to the subject and he replies how they appear to him, that is, equal or unequal. When the two equal spheres are perceived as equal, veridical perception is reached, and the fixed set has extinguished (Figure 1, p.35).



FIGURE 1 - WOODEN SPHERES USED FOR SET TESTS
IN THE HAPTIC MODALITY



FIGURE 2 - TACHISTOSCOPE AND CIRCLES USED FOR SET TESTS IN THE VISUAL MODALITY

In the visual modality, a subject is shown for 1/10 of a second two unequal circles in a tachistoscope. There is a need in the individual to distinguish which circle is smaller and which is larger. After two or three presentations, two equal circles are shown in the tachistoscope. If the subject perceives the two equal circles as unequal, a fixed set has developed in the visual modality. If the equal circles are perceived as equal by the subject, the two unequal circles are again presented for brief moments.

When set has fixated, the two equal circles are repeatedly shown until the subject perceives them as equal (Figure 2, p. 36).

In each case, the experimenter is interested in the number of trials required for set fixation and extinction. In addition, a fixed set may not be extinguished, but its presence tested after several hours or days for stability and strength using equal circles or spheres.

Fixation and Extinction of Irradiated Set

The experimenter is interested in the transfer of set from one modality to another, as well as the extinction of the transferred set.

In an experimental situation, for example, set may be established in the haptic modality and transferred to the visual modality. A subject is presented with two unequal spheres for two or three trials. At the end of the second or third presentation, two equal circles are briefly shown in a tachistoscope. If the two equal circles are perceived as unequal, a set developed in the haptic modality and irradiated to the visual modality. However, if the two circles are perceived as equal, the procedure is repeated since no irradiation is present.

When the two circles are perceived as unequal, they are briefly shown to the subject until he perceives them as equal. This results in

the extinction of the set. During extinction the spheres are not presented in the haptic modality.

In a similar manner, set may be established in the visual modality using the circles and tested for its transfer to the haptic modality using two equal spheres.

Setting to Quality

The most common method of studying setting to quality is by means of the neutral script when letters common to languages are used in the words. For example, some German words with an equal number of letters are written in Latin print and shown to a test subject by means of a tachistoscope. These words are used for the formation of a set. When a set for reading Latin script is fixated, subjects are shown a number of Russian words which are also written in neutral letters, that is, letters found in both the Russian and the Latin print such as nevod, topor, pochva and neva. The word flashed briefly by means of a tachistoscope constitute the critical part of the experiment. Usually the test subject reads a number of Russian words in Latin transcription as meaningless foreign words; the illusion is similar to the subject's perceiving equal spheres as unequal. The reading of German words in Latin transcription results in a fixed set which affects the reading of Russian words shown to the test subject (Bzhalava, 1965).

During setting to quality, certain features are noted. Fixation occurs in close to 100% of the subjects, and the set toward quality always manifests itself in an assimilative rather than a contrast manner during extinction. In extinction tests conducted by Bzhalava (1965), subjects read Russian words in Latin even though they consisted of neutral letters. In the second phase, veridical perception is mixed with

the assimilative phase; certain letters in a word are read in Russian while others are read in Latin. In the third phase, veridical perception occurs and the neutral words are read in Russian.

In experiments involving objectivization, the following procedure is used. A test subject is given a section from a story having a fascinating content. When the subject becomes interested in the plot, underlined instructions are included such as, "Turn over the page!" "Quickly turn the page!" Then immediately after the words of this instruction the text continues, but now as a section of another story having no relation to the first story. It was found that a considerable number of subjects continued to read the text without noticing the lack of correspondence between the two stories. The second half of the plot, which had no relation to the first, was completely assimilated by the fixed set which developed during the reading of the first half of the text.

V. CURRENT STATUS AND EVALUATION

Sets, as personal factors, undoubtedly play an important part in one's life (Uznadze, 1961). During a lifetime sets appear in man; once they are fixated they continue to influence activity. Identical situations will demand the help of the same sets, but as the field of human experience widens, so does man's range of sets. One must consider not only sets activated for the first time but also those developed on the basis of objectivization by unusually creative and productive personalities. The source of sets is determined by socialization and formal education.

Uznadze (1958, 1961) points out that the state of personality and not the powers and faculties of personality determines human behavior.

In the specific conditions of his activity the power of objectivization appears. On its basis appears the power to recognize identity, followed by the process of speech. Uznadze adds,

. . . thought based of necessity on the principle of identity, is indissolubly connected with speech, although not of course absolutely identical with it. . . . We have no pure thought completely divorced from speech, and we cannot therefore state that its connection with speech is accidental and fortuitous in character. Thought is connected with speech not only in fact but also of necessity (Uznadze, 1961, 191).

Human psychology is built on the principle of the activity of man as a whole, that is, on the principle of his set. The mental functions of man, such as observation, imagination, attention, thought and will, are only differentiated mental properties modifying his set. This, for Uznadze, is the meaning of set and personality, the subject of activity.

Uznadze's discussion of set has not always been available to English readers. The introduction of works in the English language (Natadze, 1962; Prangishvili, 1962; Uznadze, 1966) gave Western psychologists an opportunity to become acquainted with the basic theoretical and experimental findings of set.

Although psychologists like Teplov (1962) found the experimental work of set a useful tool in aiding the psychological study of nervous system types, others such as Yakushev (1966) argue that set can be explained in terms of reflex theory. However, Yakushev says, "The state, which Uznadze calls set, actually has a place in any reflex act (Yakushev, 1966, 93)."

It is probable that greater acquaintance with the Uznadze theory of set will evoke criticism from Western psychologists. However, experimental evidence will be necessary for logical, scientifically based comments.

The concept of set has significance in universal psychological conferences. For example, the XVIII International Congress of Psychology in Moscow, 1966, devoted one section of its meetings to the presentations of papers on set. However, the majority of contributions came from Georgian psychologists.

Uznadze has developed a large school of followers. Prangishvili has taken over the work of D. N. Uznadze as head of the Institute of Psychology in Tbilisi. Numerous psychologists, such as I. T. Bzhalava, N. L. Eliava, H. G. Natadze, V. G. Norakidze and others, continue the work initiated by D. N. Uznadze. Their work will promote greater universal familiarity with the concept of set and aid in psychological enlightenment.

Allport gives several criteria for evaluating theories. It is of interest to examine Allport's suggestions and rate their application to Uznadze's theory. The criteria are as follows:

1. agreement with the facts; the theory should be consistent or at least not inconsistent with other known facts;
2. generality;
3. parsimony; the fewer the postulates, other things being equal, the better the theory;
4. immediate experimental availability; the theory should be sufficiently operational in its statement to make it possible for it to be tested;
5. logical consistency; the theory should be free from internal contradictions;
6. explanatory value; the theory should help us to understand the phenomenon; it should provide more in the nature of an accounting than mere analogy (Allport, 1955, 8-9).

The theory of set by Uznadze has characteristics that are both consistent and inconsistent with statements expressed by other psychologists. Some statements regarding set, such as their unconscious nature (Allport, 1955; Uznadze, 1961), are consistent; however, because of many individual descriptions of set, there has been much inconsistency in the

clarification of the phenomenon (Gibson, 1941). The greatest inconsistency of facts is due to Uznadze's treatment of set as an integral state of the personality rather than a mental act, as considered by the Würzburg and Western psychologists (Uznadze, 1961).

Uznadze did not formulate his theory solely on the bases of postulates but on experimental evidence. The theory is comprehensive, dealing with both general psychology and personality. Psychology is a science of activity, and behavior depends upon set; therefore, set is basic in psychology (Uznadze, 1966). As a comprehensive theorist, Uznadze appears to be more interested in questions answered by "What" rather than "How"; the theory is general rather than specific.

Uznadze gives experimental support for many of his theoretical formulations of set, for example set excitation, extinction, generalization and irradiation. Complex psychological phenomena such as objectivization have also been investigated (Khodzhava, 1961). However, there is no strict control of variables in experimental work and it may be possible that results are influenced by variables other than those considered in the study.

In addition to examining the work of Uznadze on set, it is also the purpose of this study to examine views on set of several Western psychologists. Contributions to set will be traced from the Würzburg period to the more recent views of F.H. Allport, H. Helson, and A. Luchins. In addition, an attempt will be made to compare Uznadze's concept of set with the ideas of Helson and Luchins.

CHAPTER III

SET FROM A WESTERN POINT OF VIEW: A COMPARISON WITH UZNADZE'S CONCEPT

I. SET AND RELATED AREAS IN WESTERN EUROPE AND NORTH AMERICA

The literature on set in Western psychology is extensive and to research exhaustively the contributions of all psychologists is not the intent of this study. Although set has been used extensively in research, there have been few attempts to describe the phenomenon (Gibson, 1941; Harlow, 1949; Mowrer, 1940; Reese, 1963; Watkin, 1954). For the purpose of this study those psychologists are selected who consistently explain what the phenomenon of set means to them (Allport, 1955; Bruner, 1951; Dashiell, 1949; Freeman, 1939; Hebb, 1949, 1955, 1958; Postman, 1951; Woodworth, 1937, 1947, 1954; Young, 1925).

The work of Helson is chosen for comparison purposes since he has developed an extensive theory of adaptation level, which in his book Adaptation-level Theory has been referred to as set (Helson, 1964). Although Luchins has not developed a theory of set, he defines the term and consistently emphasizes its importance in problem-solving (Luchins, 1966). Only close examination of their understanding of set will reveal similarities and differences with regard to the views held by Uznadze (1961, 1966).

Early Developments

The concept of set has enjoyed a long and varied history in psychological literature (Gibson, 1941). One of the earliest and most enduring concepts of set has been that of Einstellung, postulated in 1890 at Würzburg by Marbe, Ach and Watt. This concept was derived

through introspective reports of cognitive processes.

Marbe, in a study of judgment of weights, found that the process of introspection did not convey how judgments are made. The subjects judged a weight as heavier or lighter, but the sensations and images they reported did not describe the process of how they reached their judgment (Watson, 1963, 271).

Watt studied the role of association in solving problems. The conscious part of the problem is the instruction given to the subject and his acceptance of the task (Aufgabe). The task precedes a later unconscious course of events, that is, the conscious Aufgabe brings about an unconscious set or Einstellung in the subject (Forgus, 1966, 268-281). Watson adds:

Watt and Ach in related research in studying association held that what happened was that the organism had a set or to use Ach's term, a determining tendency to react in a way the instruction given called for. If in advance of exposure to material, one has decided to subtract, seeing a 6 and a 4 produces the response 2 not 10, which a determining tendency to add would have produced to the same stimuli. Once the task has been accepted and the set has been adopted, the actual performance runs off with remarkably little conscious content (Watson, 1963, 272).

Uznadze is not in agreement with the Würzburg psychologists; they treat set as a mental act and not as an integral state of the individual. Their work, however, provided Uznadze with ideas for further theorizing (Uznadze, 1961, 13-15).

Western Views on Set

A. Young

Young conceives of set as a biological rather than a mental phenomenon. He makes the following comments regarding set:

1. Organic sets may persist for a long time or for a relatively brief period of time.

2. In many cases an organic set is released when its conscious purpose has been accomplished.
3. The maximum complexity of set as tested by instruction varies among individuals and in a definite manner with age.
4. Two or more sets may exist simultaneously; their meanings may be opposed so that conflict results.
5. Temporary sets may be established through verbal instructions or through non-verbal conditions (Young, 1925, 472).

B. Woodworth

Woodworth thinks that behavior always involves selectivity and set or motive. Selectivity involves attending to certain stimuli and certain responses; set implies that the organism is prepared at any moment for the stimuli it is going to receive and for the responses it is going to make. Because a motive involves a readiness or a preparation for a certain kind of behavior, Woodworth considers a motive to be similar to set (Woodworth, 1937). Woodworth describes several types of sets:

1. A preparatory set is a state of readiness to receive stimuli or to make a movement. If one labels the process S-O-R, then set would be the "O" factor. The set is controlled by the nervous system and it is known, not assumed, that states of readiness exist in the nerve centers. Probably brain readiness, rather than muscular tensions, is responsible for the contribution of the "O" factor. Thus set is treated as a mediating variable.
2. A set is a handicap instead of a help if it is not suited to the present situation or to the problem at hand. For example, a set that is biased against a certain person prevents one from giving that person a fair hearing.
3. Individuals have a set to start and to finish or to continue; the latter is similar to the Zeigarnik Effect (Zeigarnik, 1927). Any set is selective, favoring certain responses and preventing others. For example, while looking for a lost object, one's set favors the seeing of that object. A readiness for one set precludes at the same time a readiness for other acts.
4. Sensory sets exist in looking and listening, motor sets in movement and mental sets in remembering and planning. Response is determined partly by the stimulus and partly by the set at that moment. Set favors certain responses and prevents others from occurring, and promotes quickness, accuracy and efficiency.
5. A set which one develops while observing a situation persists after cessation of observation if one remains in the

situation. This is termed a situation set.

6. Situation set is a function of the cortex. A loss of any considerable portion of the cortex impairs a rat's ability to form a good situation and goal set. Such adjustment may probably be an activity of the brain as a whole rather than of any single center. Frontal lobes may be concerned with directing activity toward a goal, while the posterior half of the cortex appears to be concerned with grasping the situation. Since stimulus and goal are involved in the same adjustment, the frontal and posterior parts must work together whenever an individual is dealing effectively with the environment.
7. A goal set is objective since its aim is reaching a certain place, obtaining a certain object, or producing some change in the environment. While the individual is set for reaching a goal in a certain situation, he receives stimuli and makes responses which have an objective reference (Woodworth, 1947, 154).

Woodworth, reporting several of his experiments on set, concludes that task set is typically conscious and does not function automatically. Set must be presented as a conscious undercurrent if it is to be effective; it is usually not reported as a sensory, imagined or motor experience, but simply as a background awareness and as a conformity of one's responses to the task at hand. When one awaits stimuli, some process in the brain prepares for the quickest possible reaction. When the brain is in this state of readiness, the reaction is involuntary and no new impulse is needed after the impingement of the stimulus. If the organism is unprepared, the impulse which follows the impingement of the stimulus is a set of the nervous system which facilitates a particular response (Woodworth, 1954).

An experimental example of set is found in the perception of lifted weights, first demonstrated by Müller and Schumann in 1889. The subject transfers motor adjustments (Einstellung) from the first lift to the second; the adjustment to the second weight depends upon the manipulation of the first weight. The idea remains that an adjustment for the standard stimulus is held until the variable stimulus is received. The

variable stimulus appears strong or weak according to whether it is stronger or weaker than the stimulus for which one is adjusted (Woodworth, 1954, 260).

C. Dashiell

Dashiell (1949) looks upon man's activity as being organized about slowly generated and long lasting reactions. Man is an organism whose activity, though varying in detail from moment to moment, shows cores of continuity. What one does is influenced by the way in which he happens to be predisposed, that is, how he is set. Examples from everyday life include a sprinter awaiting the signal of the pistol shot, an open field runner on the football field, or the difficulty one encounters in shifting keys while singing.

Dashiell (1949) refers to set as attending to particular stimuli which facilitate a response. The act of paying attention is one of positive adjustment for better sensing of the necessary stimuli and of negative adjustment for the exclusion of irrelevant stimuli. Support for the more local adjustments of receptors is furnished frequently in more widely distributed postural changes, as for example, in turning the head, leaning forward or shading the eye. Certain changes in respiratory and circulatory functions also contribute to the more adequate reception of stimuli, as well as diffuse muscular strains that are according to Razran (1961) part of the attending person.

The psychological bases of reacting indicate that striate muscle tissue can undergo sustained tonic contractions as well as short-lived phasic contractions. When a person is set, the condition is thought to involve the tonic states of musculature. Neurologically, the determining

effect of set may be reducible to the principles of facilitation and inhibition between action systems. When one stimulus arouses a certain neural excitement eventuating in a reaction, the neural excitement will spread into other action systems and will tend to facilitate some activity and to inhibit other activity. A later stimulus which is conditioned to arouse one of the facilitated systems will be more effective than a stimulus which tends to arouse inhibited systems. As Dashiell states:

. . . the question whether some form of the muscular or some form of the neural should eventually prevail is a challenge to be met by investigation, in which the contributions of the psychologist will be crucial (Dashiell, 1940, 296).

Dashiell (1940) adds that the problem of set is one of measurement. Methods used are as follows: degree of readiness in terms of the acceleration or retardation of work, the index of speed of reaction, magnitude of reaction, correlation with the alpha wave, and the time error in lifting two unequal weighted objects.

D. Freeman

Freeman (1939) describes set as the covert tension in the skeletal muscles which precedes or follows overt reactions of those muscles and the effects of the central nervous system backlash from the proprioceptive stimulation attending these covert tensions.

With regard to tension pattern, there is a general supportive function consisting of diffuse tensions in muscles and a specific supportive function consisting of tensions in differentially localized muscle groups. The tension region represents the immediate preparation and support for the ensuing or continuing activity for which the organism is set. The set tends to be identical with the tensions of those

muscles involved in the full overt response. The general tensions in other muscles serve as supportive excitation, both peripherally and centrally, of the focal set (Freeman, 1939).

Freeman's theory of set involves both peripheral and central factors (Freeman, 1940). When a tension in muscles occurs, there is a backlash to the central nervous system, creating a differential brain state that further lowers the threshold of the motor pathways through which the ongoing response will occur. If the same overt reaction was to be elicited by several classes of stimuli, small changes in the tension pattern would establish, by backlash action, a lowered threshold for the stimuli about to be presented. The process represents the motor set or adjustment involved in sensory accommodation, together with other postural changes induced by the stimulus object.

There are two aspects to the neuromotor mechanisms which sustain activity. The phasic system is concerned with voluntary muscular contractions that are more intensive, extensive, rapid and short-lived. In the tonic system there is a continuous flow of impulses sent to the muscles, producing incipient tensions or "tonic" contractions. These are slower than the phasic and keep the muscles in a state of readiness for the phasic contractions. Thus, Freeman considers set phenomena to be expressions of the limiting effects of proprioceptive tonic aspects of responses upon exteroceptive phasic activity. Phasic exteroceptive excitants come and go, but the stream of proprioceptive tonic impulses is measured and continuous. The tonic pattern is thus well adapted to the task of preserving the organism's homeostatic balance and equilibrium (Freeman, 1948).

E. Hebb

Hebb employs set in the distinction between voluntary and involuntary acts. A voluntary act is determined by a phase sequence or conceptual series with some duration in time to which both sensory and central facilitation contribute constantly. The consequences are recurrent as well as anticipatory, such that the voluntary act is influenced by immediate memory and set as well as by an expectancy of the future. Empirically, a voluntary act appears during periods of selective responsiveness, conditioned both by earlier stimulations (the influence known as set) and by present stimulation.

An involuntary act is not a function of set or any preparation of the subject by instruction or the like. Rather, it is determined by the stimulation of the moment plus the general physiological condition of the organism. The occurrence of an involuntary response may be subject to the influence of set. Certain involuntary acts may show purposeful motor variability, or may vary in pattern as a function of set (Hebb, 1949).

Finally, Hebb (1958) attempts to distinguish between attention and set, two closely related terms referring to the same type of selective action by central processes. Set commonly refers to selectivity among motor outputs (which of two possible responses will be made to a given stimulus) and attention refers to the selectivity among sensory inputs (which aspects of the stimulus object will be responded to).

F. Allport

For F. Allport (1955) the phenomenon of set applies not only to perception but to practically all types of behavior. The very fact of its ubiquity and its potentialities for facilitating or strengthening

what is perceived requires that it be incorporated into any theory intended to have a fair degree of completeness.

From psychological experiments, F. Allport lists several facts regarding set which he believes clarify the meaning of the term. The facts are as follows:

1. There is some preparatory or facilitating condition of the organism that precedes, accompanies or even outlasts the completely executed behavior; it has the effect of making the process occur with greater promptness, speed of execution, energy or magnitude.
2. In some instances, the condition seems merely to prepare or make ready the full behavior process; in other cases, it sustains, prolongs or enhances during its entire course.
3. Response always represents exactly the same behavior as that for which the organism is prepared by the set.
4. Set always appears as a selective process.
5. Sets can stand in an antagonistic relation to one another and have negative or inhibitory as well as positive aspects.
6. In preparatory and sustaining sets, there is a peripheral sensory as well as a peripheral motor aspect.
7. When two stimuli occur simultaneously, the one to which the subject attends is experienced first.
8. Since set is a property of the organism, two different sets built up at different times can facilitate two different percepts from the same stimulus pattern.
9. Two classes of preparatory set have been distinguished, expectancy and intention. The first is mainly sensory in character; one "expects" a certain stimulus to appear and gets ready for it. The second type of set is one in which the subject is set strongly for the response.
10. Preparatory sets may require a long or a short interval of time in preparing one for a response.
11. Getting ready for an activity may be either a voluntary or an involuntary matter.
12. Set may involve or be involved in learning.
13. Though sets are specific in relation to activity, they can also be generalized.
14. Sets can be built up either consciously or unconsciously.
15. Sets can be built up and become effective in a variety of ways; for example, by instructions for a task, or during the course of the task itself from regular and repeated conditions under which materials are presented. Sets can be established or brought into play by bodily needs or emotions or as long standing characteristics of personality (F. Allport, 1955, 213).

F. Allport (1955) describes the directive-state theory advanced

by Postman and Bruner. The theory deals with a concept of set and the role it plays in perception. The determinants of perception are divided into the formal and the functional. The formal determinants include the stimuli, the effect of stimulation upon the receptors, afferent neurons and the cortical sensory areas. These represent the innate and relatively unchangeable endowment of the individual. The functional determinants are related to the control of the "higher-level" processes concerned with interaction. Included in the category are the needs, tensions, values, emotions and past experience of the individual.

Experimental evidence is given for the following:

1. Bodily needs tend to determine what is perceived.
2. Reward and punishment associated with the perceiving of an object tend to determine what is perceived.
3. The values characteristic of the individual tend to determine the speed with which words, related to those values, are recognized.
4. The value of objects to the individual tends to determine their perceived magnitude.
5. The personality characteristics of the individual predispose him to perceive things in a manner consistent with those characteristics (F. Allport, 1955, 309).

G. Postman and Bruner

The hypothesis theory, which is a reformulation of the directive-state theory, states that cognitive processes represent "hypotheses" which the organism sets up or are evoked by the particular situation. The hypotheses (or sets) are largely in the background of mental processes and are usually unconscious. Adjustment to the environment continues by the process of hypothesis confirmation or rejection. If the hypothesis is confirmed, the answer comes into consciousness as some kind of percept, idea, image or memory (Postman, 1951, 242-255).

The formulation of hypotheses in the situations concerned, their testing and their ultimate confirmation or rejection, constitute the

processes of thinking, perceiving, and remembering. When one is thinking or remembering one is evoking and testing organismic hypotheses. Individuals possess predispositions, sets or expectancies that serve to select, organize or transform information that comes to them via the sensory input. The hypotheses or sets are evoked by the arousal of central cognitive or motivational processes, depending upon environmental situations (Postman, 1951, 256-273).

If the information from the clues confirms the hypothesis, a stable perceptual organization results. If hypothesis confirmation is not achieved, the hypothesis is modified. Thus a cycle of trial and check is involved. The strength of any given hypothesis depends upon the frequency of its past confirmation, the number of alternative hypotheses and the motivational or cognitive support the hypothesis acquires from the attendant circumstances. The stronger the hypothesis, the greater the likelihood of its arousal and the less the amount of appropriate and supporting stimulus information that will be required for confirmation. When appropriate information is lacking, the perceptual organization tends to be determined directly by the dominant hypothesis. Where the hypothesis is weak, a large amount of appropriate and supporting information is necessary for its confirmation (Bruner, 1951, 121-148).

A Comparison

Some of the Western views on set (Allport, 1955; Dashiell, 1940; Woodworth, 1947) compare with the Georgian views (Norakidze, 1958, 1966; Prangishvili, 1958; Uznadze, 1958, 1961). The following descriptions of set are similar to views held by Uznadze:

1. Set is a state of readiness to make a response; set is a form of mediation (Woodworth, 1947).

2. What one does is influenced by his predisposition or set at that moment (Dashiell, 1949).
3. A voluntary act is influenced by both sensory and central processes, that is, by set (Hebb, 1949).
4. Set refers to selectivity (Hebb, 1958).
5. Response always represents exactly the same behavior as that for which the organism is prepared by the set (Allport, 1955).
6. Set always appears as a selective process (Allport, 1955).
7. Set may involve or be involved in learning (Allport, 1955).
8. Sets may be generalized and built unconsciously (Allport, 1955).
9. Sets may be established by instructions and by bodily needs (Allport, 1955).
10. Sets are usually unconscious (Postman and Bruner, 1951).

Uznadze, on the other hand, takes a holistic approach to set.

He adds:

The set is a primary, integral, undifferentiated state. It is not a local process--rather it is a state characterized by irradiation and generalization. . . . The development of conscious mental processes is preceded by a state which cannot in any degree be regarded as a nonmental, purely physiological state. We call this state set--a state of preparedness for a definite activity, its onset depending on the presence of the following conditions: a need, actually felt by a particular organism, and an objective situation for the satisfaction of this need. . . . The study of set is undoubtedly of great scientific interest, for without a specific analysis of it there would be no hope of obtaining an adequate understanding of human psychology (Uznadze, 1961, 82).

II. HELSON'S ADAPTATION LEVEL THEORY

Since Helson (1964) notes that his concept of adaptation level is often referred to as set, it may be desirable to briefly examine his theory and compare it with that of Uznadze.

According to Helson (1964) every individual acquires a frame of reference, a personal and subjective scale with which to judge stimuli. Every organism is also able to categorize experience in some kind of order; the order is dimensional and quantitative. One achieves order by subjectively establishing some neutral, indifferent region in his

quantitatively arranged experiences. Using all the stimulus-magnitudes to which he is accustomed as a "frame" for his judgments, an individual establishes a standard. Stimuli are judged as positive if they fall above the adaptation level or standard and negative if they fall below the level. For example, 275 grams may be a "medium" stimulus for a series of weights ranging from 200 grams to 400 grams. The neutral or medium position is the adaptation level of the subject.

Adaptation level represents the "centering" of an organism with respect to stimuli confrontation; it is the true zero of functioning. For example, the adaptation level may be a reference point for weights, such that objects above the level seem heavy while objects below seem light. The adaptation level also determines the structure of the perceived field. By structure Helson means an array of values along some quantitative dimension which is abstracted from the stimulus object.

An organism has an adaptation level for every moment of stimulation, although the level may change with different conditions of stimulation and with time. The level is also a function of all the stimuli acting upon the organism at any given moment, as well as stimuli that have acted in the past. Consequently, the adaptation level may be high, moderate or low. However, when a stimulus is presented which is far above the stimulus range in the series employed in establishing the level, the level rises and many judgments of previous stimuli then become "negative." When adaptation level is near the middle of the series, the number of positive and negative judgments are almost equal.

Formation of Adaptation Level

The adaptation level is formed by an unconscious process of pooling stimuli whereby the organism arrives at some average of its

magnitude-experiences. Pooling is both a physiological and a psychological phenomenon. Adaptation level is derived from three different classes of stimuli involved in the pooling:

1. The stimuli responded to and in immediate focus of attention.
2. All other stimuli immediately present and forming a background or context for focal stimuli.
3. All determinants of behavior which have their locus within the organism, such as the effects of past experiences and constitutional and organic factors which interact with present stimulation, are treated as residuals (Helson, 1959, 567).

There are also several basic postulates to adaptation level theory:

1. All behavior centers about the adaptation level or equilibrium level of the organism.
2. Behavioral equilibrium depends upon the interaction of all stimuli confronting the organism (simultaneous pooling).
3. The adaptation level is approximated as a weighted log mean of all stimuli affecting the organism.
4. All dimensions of present and residual stimuli are related to the adaptation level.
5. The existence of an equilibrium level immediately indicates the bipolarity of behavior. Stimuli above, near and below the adaptation level elicit different responses.
6. Unless counteracting residuals are strong, the value of adaptation level tends to be the weighted mean of the stimuli confronting the organism. For example, the weighted stimulus evoking a medium response in a series of stimuli ranging from 200 grams to 400 grams is about 250 grams.
7. Fixed stimuli do not have a constant effect on organisms; properties of stimuli depend upon their relation to the prevailing adaptation level.
8. Learning, acquisition of skilled acts, and the manifestations of capacity or ability represent ways in which the organism adjusts to problems and tasks. These may be considered meaningfully within the framework of adaptation level theory.
9. The behavior of groups can be considered in terms of group adaptation levels (Helson, 1959, 569).

Further Explanation of the Theory

The role of adaptation level may be demonstrated as follows. The subject judges a set of stimuli (for example, weights called series stimuli) with respect to some standard, which is usually identical with

the middle stimulus. In the method of absolute judgment, the subject judges each weight on an absolute scale from very, very heavy through medium to very, very light. Subjects lift a given weight and give judgments of the series stimulus in terms of an absolute scale.

Helson has devised a quantitative method, a weighted log mean formula for arriving at a single value for the adaptation level. He notes that when no background stimulus is present, the stimulus judged "medium" is the log mean of the series stimulus minus a value which is three-fourths the size of the step interval between the stimuli (the "d" factor). Using a background stimulus and absolute judgments, the stimulus judged medium proves to be the weighted log mean of the series and background stimulus minus the "d" factor. In lifted weights, the log mean of the stimuli must be weighted by three and the background stimulus by one in order to approximate the adaptation levels actually observed (Helson, 1948, 1959).

The weighted log mean formula is important not only in providing a quantitative method of dealing with psychological phenomenon but also in making explicit the fact that the pooling of focal, background and residual stimuli actually occurs. Since the weighted log mean formula yields a single value, the adaptation level, quantities entering into the adaptation level must interact to establish a common pool representing the level of functioning in the organism.

The weighted log mean formula is neither true nor false as it stands (Helson, 1964). It is true when specific values assigned to the weighting constants are verified by experimental data and false when experimental values of adaptation level are not identical to observed adaptation level. As additional factors are found to influence

adaptation level, they can be incorporated into the weighted log mean formula. The weighted log mean formula defines the value of adaptation level and makes possible the determination of the relative contribution of focal, background, and residual stimuli to resultant adaptation levels. Furthermore, the simple weighted log mean formula may be modified to take into account cases more complicated than the example of the lifted weights (Helson, 1959).

Outside the laboratory, the stimuli to which we react are not unidimensional in character. For example, our like or dislike for a picture depends upon color balance and the subject matter; the individual can respond to complex objects and events as wholes. One must assume that organisms pool incoming data of all kinds with the result that the ensuing behavior represents some net effect of all the attributes of the stimulus taken in conjunction with the prevailing state of the organism (Helson, 1951).

In conclusion the work of Helson is best appraised by the following statement:

. . . the problem of the frame, however, is far from solved and will probably take us into regions hitherto unexplored. Perhaps it is not a frame of reference we are seeking, but some general principle of structuring. Whatever the answer may be, it is clear that the phenomenon now called norm and frame of reference, as well as the more precise concept of adaptation level, add another chapter to the fascinating, though bewildering, story of perception (F. Allport, 1955, 255).

III. THE WORK OF LUCHINS ON SET

Views on Set

According to Luchins set has been with us for nearly the entire history of psychology. During that time a variety of descriptions and

speculations have been proposed to account for its existence. No one conceptualization has been adequate, probably because the nature of set is very complex (Luchins, 1966).

Set has been observed in nearly all areas of psychology and various explanations have been proposed (Gibson, 1941; Luchins, 1946). The concept of set is used to support the idea that an organism does not react passively to stimuli but selects stimuli and directs its responses. On the other hand, set has been opposed by behaviorists who explain behavior solely in terms of stimuli and responses. Because of the popularity of behaviorism in America, set was not studied prior to the 1940's. However, there has been some acceptance of the phenomenon of set, resulting from research in perception and from the neo-behavioristic approach to verbal learning (Luchins, 1966, 105-106).

Luchins has investigated the concept of set or Einstellung Effect to test whether in solving a series of problems one develops mechanization of behavior, a rigidity, or a tendency to continue the solution of problems in a manner similar to subsequent solutions. He adds:

Einstellung--habituation--creates a mechanized state of mind, a blind attitude toward problems; one does not look at the problem application of a used method. . . . Einstellung produces a surprising failure to solve a simple problem . . . as it blindfolded subjects to direct solutions (Luchins, 1942, 15).

Method of Experimentation

Luchins utilized the following experimental procedure. Subjects are given a series of water jug problems which are solvable by one method. These are followed by similar problems that are solvable by a relatively more simple and direct method. There are a total of eleven problems to solve. For example, in the second problem the subject is given an empty 21 quart jar, an empty 127 quart jar, and an empty 3

quart jar and is required to measure out 100 quarts of water. In the ninth problem, the subject is given an empty 28 quart jar, an empty 76 quart jar and an empty 3 quart jar and is asked to measure out 25 quarts of water. Finally, in the eleventh problem, the subject is given an empty 14 quart jar, an empty 36 quart jar and an empty 8 quart jar and is asked to measure out 6 quarts of water.

If one labels the jars A, B, and C respectively, then problems 2 to 6 are solved by the formula $B-A-2C$. The method is known as the Einstellung or the E method and problems 2 to 6 are known as the E problems. Problems 7 to 11 are called the test problems, since they indicate the effect the E method has on the subsequent problems. Problems 7, 8, 10 and 11 are solvable not only by the E method but also by the direct methods of $A-C$ or $A+C$ respectively. Problem 9, the test for extinction, cannot be solved by the E method but only by the $A-C$ formula. If the individual develops an Einstellung in the first two test problems (7 and 8), one may note the subject's ability to recover from the Einstellung and solve the test problems 10 and 11 by a direct method (Luchins, 1959, 295).

In summary, the following water jug problems are used:

1. problems 1 to 6 create the set;
2. problems 7 and 8 are the critical tests which test for the existence of set;
3. problem 9 tests for experimental extinction;
4. problems 10 and 11 are the critical problems, used as indices to test for recovery from Einstellung.

According to Luchins (1966) the series of problems has been used to demonstrate the Einstellung Effect in learning by repetition. The experiments demonstrate the liability of using isolated drill in initial learning, since the drill produces positive transfer with negative

results. The problems are also becoming popular for testing hypotheses derived from various theories of learning, personality, thinking and teaching. However, the research has not yielded a decision as to the nature of set nor has it led to the discovery of variables that extremize the Einstellung Effect. One of Luchins' major interests is the manner in which the set can be maximized or minimized (Luchins, 1966).

Maximizing Einstellung Effect

Luchins finds that the Einstellung Effect is maximized by:

1. presenting the problems as a stressful speed test;
2. increasing the number of set-creating problems to ten;
3. telling and/or helping the subjects to generalize the rule that solves the problem;
4. using very complex water jug problems instead of the problems of the basic experiment (Luchins, 1966, 107).

Generally, the methods that maximize the Einstellung Effect narrow the subject's view of the problem. He is not oriented to survey the problem, to study its logical structure and to find the most appropriate solution. Instead, the subject repeats what he did before. He carries out a series of steps in a piecemeal manner, much like a computer programmed for a specific mathematical problem.

Minimizing Einstellung Effects

Although experimentation is often frustrated by school-learned attitudes to problem solving and to school tests, Luchins finds that the Einstellung Effect can be reduced by:

1. separating the set-creating problems from the criticals in various ways, as for example, by hour or day time intervals;
2. introducing an experimental extinction problem involving a different operation immediately after the set-creating problems;
3. only giving one or two set creating problems;

4. giving subjects a warning, such as "Be careful with problem 9";
5. varying the number of jars used to solve the problem instead of the usual number in the set-creating problems (Luchins, 1966, 110).

The reduction of the Einstellung Effect is most successful when the subject's attitude or assumptions lead him to view all the problems as one series, and if he generalizes or seeks a rule to solve the problems (Luchins, 1966, 112).

One must note that Einstellung is not bad per se. A tendency to repeat has value. By reducing a process to a mechanical routine, one is free for more creative activity. However, one has to guard against merely becoming a creature of habits which are best learned as tools rather than forces in their own right.

Further Research

Research is needed to find methods that aid subjects to view the evidence in problem situations (Luchins, 1966). Individuals must be able to face different problem situations by searching and trying out various hypotheses concerning the structure and requirements of the problem. To repeat blindly a repertoire of responses learned in the past is not sufficient. Research may yield empirical descriptions of factors that affect Einstellung with emphasis on creativity instead of the usual mechanization of education. Further research might also yield the kind of empirical data on which psychologists could build a theory of set (Luchins, 1966, 114).

IV. HELSON'S CONCEPTS COMPARED WITH THOSE OF UZNADZE

The major difference between set and adaptation level lies in the

theoretical approach. For Uznadze the concern is with the internal structure which regulates behavior. Set is a very important feature of every organism, since it is the basis for all behavior. In the presence of a need, an approximate situation and basic perception, a set emerges, giving direction and purpose to behavior. Set is central to the theory of Uznadze. Helson, from a psychophysical point of view, is concerned with the adaptation of the individual to the incoming stimuli. Whereas set is a readiness for behavior, the adaptation level implies a particular reference point for the judgment of incoming stimuli. Helson argues that by pooling stimuli and by applying mathematical formulae, one may distinguish or approximate a response. Helson distinguishes focal, background and residual stimuli that influence human beings. Each stimulus is essential, but the problem is to find the amount of each type required to effect a particular response. For Helson, adaptation level is determined largely by the properties of the stimuli. Set and adaptation level are not similar phenomena (Bzhalava, 1965, 115-126).

Helson is concerned with quantifying his concepts where the adaptation level is a weighted mean of focal, background and residual stimuli. The basic formulae are:

$$A = \bar{X}^p B^q R^r$$

where p, q, r are weighting coefficients and $p + q + r = 1$

$$\log A = p \log X + q \log B + r \log R$$

where A = adaptation level

\bar{X} = geometric mean of the focal stimuli

B = background stimuli

R = residual stimuli

Uznadze, on the other hand, is not interested in applying mathematical formulae to set concepts. His concern is the experimental study

and application of set (Uznadze, 1961, 55). Since Helson is interested in quantification, set and adaptation level may be described as a hypothetical construct and an intervening variable respectively. Helson adds:

Adaptation level represents the zero of function and since it is always associated with positive values of stimulation, stimuli below as well as above level exert positive effects on behavior. . . . With positive gradients of excitation responses are of one kind, e.g., blue-green, pleasant, approach; with negative gradients they are of the opposite kind, e.g., red, unpleasant, avoid; and with zero gradients responses are neutral, indifferent or absent, e.g., gray, affectively neutral, no response. Behavior is therefore basically bipolar in nature (Helson, 1964, 63).

Uznadze does not describe set as having a zero of function; set represents the basis of activity. Uznadze does not speak of bipolar behavior; set does not produce degrees of response.

The emphasis in adaptation level theory is upon properties of the stimulus. For Helson every change in a living organism involves adaptation, for in all cases life consists of a continuous adjustment of internal to external relations. Past stimulation influences present behavior as part of the residual stimuli that affect present behavior. For Uznadze stimulation is necessary for basic perception, a factor necessary for set formation.

It is Helson's consideration that adaptation level refers not only to individual adjustment but also to group adjustment. He adds, "group behavior can be conceived as the resultant of pooled individual behaviors and hence as functions of individual modes of adjustment (Helson, 1964, 63)." Set for Uznadze is not a group phenomenon; he clearly states that set is an individual characteristic. However, it is possible to group people who have similar set characteristics.

The role of adaptation level can be shown by lifted weights. The

subject judges a set of weights with respect to a standard which is usually identical with the middle weight. For example, the adaptation level in a novel situation involving weights from 400 to 600 grams is 418 grams. However, following six sets of preceding lighter stimuli, the adaptation level becomes 361 grams. On the other hand, the adaptation level for 100 grams to 300 grams weights without previous experience is 165 grams, but after six sets of preceding heavier weights it becomes 186 grams. Thus higher adaptation level means lighter judgments and lower adaptation level means heavier judgments.

Uznadze also uses weights in his experimental procedure. The subject is given a heavier weight and a lighter weight (constant volume) for several trials which create in the individual a set to perceive the spheres in a certain manner. When two spheres of equal weight are presented, the subject usually perceives one of the spheres as being heavier. In addition, the central nature of set may be demonstrated by the fact that a set established in one modality can be transferred to another modality.

Helson says:

Responses to stimulation are manifestations of positive or negative gradients from level. Intensity of response is a function of distance from, or ratio of stimulation to, prevailing level; the greater the magnitude of the ratio or distance, the steeper is the excitation gradient and the greater is the response (Helson, 1964, 63).

For Uznadze, there are no excitation gradients or degrees of responding. The approach is holistic; activity either occurs or does not occur.

Uznadze sees man as an active organism; he concurs with the concept of competence motivation which postulates a neurogenic motive to deal effectively with the environment (White, 1959). On the other hand,

Helson does not postulate any type of need that may be necessary for the formation of adaptation level.

Adaptation time is individually determined. One subject may take fifteen times longer than another person to form an adaptation level. Some people adapt quickly in all bodily regions while others adapt quickly in some regions and slowly in others (Helson, 1964). Set has similar characteristics. Uznadze has shown that there are intra-individual and inter-individual differences in the rate of fixation and extinction in the various sense modalities.

Helson further notes that organisms are space-time averaging mechanisms in which the dimensions of the object and events contribute differentially to the formation of adaptation levels. Among the more obvious and important weighting factors are area, intensity, frequency, nearness and recency of stimuli. Less obvious but often important in the fixing of levels are tasks, instruction, self-instruction, organic state, cognitive systems and the genetic factors. Helson gives instruction (strategies involved in response sequences), cognitive systems and genetic factors a secondary place in his theory (Helson, 1964, 453-517). From the point of view of education, Uznadze places great emphasis on instruction in the formation of sets, and defines the process of education as the development of appropriate sets (Uznadze, 1966, 243).

Helson does not deny the validity of set, but the concept is of secondary importance. He adds, ". . . at first sight it might seem we are dealing merely with another example of set, Aufgabe or Einstellung; terms like set and Aufgabe imply singleness of task or universe of discourse . . . (Helson, 1964, 439)." The concept of set described by Helson is similar to that of Ach (1951). Uznadze (1939) used the term

Einstellung to denote readiness for activity, rather than the narrow, peripheral meaning of task set.

Both Uznadze and Helson stress the importance of perception and thought. When stimuli first impinge upon a sense organ, sensation results. For the full perception to occur, a corresponding set must develop. Consequently perception and set have an integral relationship (Uznadze, 1961, 171-172). For Helson, the pooling of focal, contextual and residual sources of stimulation provide a unitary account of perception. Furthermore, the contributions of each may be quantitatively evaluated (Helson, 1964, 233). Helson compares perception with thinking and cognition:

Perception

1. Focal stimuli
2. Background stimuli
3. Residual stimuli

Cognition

1. Predominant ideas, concepts
2. Associations, connotations
3. Remote and spontaneous associations; physiological and other determinants of thought processes.

. . . we must use the term predominant idea where other writers have used set, expectation, expectancy, attitudes, goal, Aufgabe, or Einstellung. We prefer the term predominating idea because it is analogous to the focal stimuli in perception, and because it points to actual properties of the concepts around which systems of thinking develop (Helson, 1964, 468).

Some features of predominant ideas are:

1. They are vivid, intense and persistent.
2. They appear in intense or long periods of concern.
3. They are rich in connotation and denotation.
4. There is suggestion to problems.
5. Fruitful predominant ideas suggest new problems in addition to solving old ones (Helson, 1964, 469).

Thus Helson adds ". . . cognitive acts, sensory-motor responses, skills and learning are differentially affected by focal, background and residual stimuli and hence are functions of prevailing level no less than perception and judgment (Helson, 1964, 63)."

Uznadze places emphasis on thought as one of the outstanding features of man. Objectivization is responsible for the formation of thought wherein an old set is replaced by one which is appropriate to the new situation. Since objectivization cannot arise outside of one's set, it is obvious that thought is determined by one's established sets. If a person is unable to objectivate a situation, then activity arises directly from the individual's impulsive sets.

In conclusion, the theories of Helson and Uznadze, even though similar in some aspects, such as the importance of stimuli in behavior, cannot be treated as synonymous. Set for Uznadze is a basic, underlying stratum of human activity; adaptation level is a frame of reference, obtained by pooling stimuli, for bipolar behavior.

V. THE WORK OF LUCHINS AND UZNADZE: A COMPARISON

The work of Luchins has drawn attention from Soviet psychologists who accepted his paper on set for presentation at the XVIII International Congress of Psychology in Moscow in 1966. With the publication of a major work on set Luchins (1942) has continued to investigate certain aspects of set, namely factors which either maximize or minimize the Einstellung Effect in problem solving. The experimental procedures and the set concept have similarities to some of the Georgian set formulations.

For Luchins, set or Einstellung enables one to persevere in a habitual mode of response. Although Luchins does not give an explicit definition for the term set, his writings (Luchins, 1942, 1946, 1966) imply that set is more synonymous with habituation in behavior than with a form of readiness.

The experimental portion of Luchins' work has similarities to those of Uznadze, namely the idea of set fixation, set testing and set extinction. Luchins' eleven water jug problems contain some of the important aspects of set experimentation. For example, problems one to six create a set in the individual, problem seven and eight test for the existence of a set, while problem nine tests for the extinction of set. The procedure is similar to that used by Uznadze. Although spheres and circles are used instead of water jugs, the procedure entails set fixation and extinction in the haptic, visual and kinesthetic modalities. However, the experimental procedure used by Uznadze is simpler compared to the method used by Luchins. Uznadze is more thorough in the set tests; he is able to test for irradiation and generalization of set, study the number of trials necessary for set fixation and extinction, and thus classify individuals according to their set patterns.

Both Luchins and Uznadze are interested in the role that set plays in the process of education. Luchins finds that set has an important role in problem solving since it saves time in the process. Uznadze goes one step further and notes that an individual has the power to objectify a situation and on this basis proceed with activity initiated by a new set, rather than proceed on the basis of impulsivity. Luchins does not refer to objectivization in his works.

As Gibson (1941) has pointed out, the concept of set continues to have different meanings to different people. This is especially true for many Western psychologists who do not agree on a common meaning for set. This is not true for Georgian psychologists who have adopted the formulations of set as described by Uznadze. The concept

of set does not have identical meanings for both Uznadze and Luchins. Both Uznadze and Luchins emphasize the central, cortical nature of set; however, unlike Uznadze, for Luchins set is auxiliary to activity. Luchins, unlike Uznadze, does not have a theory of set; he uses the term in his writings, and denotes its importance, but he simply does not go far enough in his explanations. Luchins notes that one must develop a theory of set and only further research can make this possible (Luchins, 1966, 114).

Thus, the important difference in the set concept for Luchins and Uznadze is that set for Uznadze is a cortical phenomenon, an integrity which is basic to behavior. Luchins' use of the term "mental set" has a similar meaning to task set (Luchins, 1966; Woodworth, 1947). Uznadze says that set is basic to cognition, that it plays an important role in his objectivization, thought and memory. Luchins does not give set the same important role in behavior.

Unlike Uznadze, Luchins does not devote his full time to the research of set. An examination of his writings reveals that Luchins prefers to employ the concept of Einstellung without building a theory of set. If Luchins uses his experimental findings to write a theory, as did Uznadze, then probably he would rank equal to the Georgian psychologists in the area of set.

CHAPTER IV

AN EXPERIMENTAL APPLICATION OF SET: THE WORKS OF EYSENCK AND NORAKIDZE

I. A SPECIFIC STATEMENT OF THE PROBLEM

Although the work of Eysenck is well known to Western readers, Uznadze makes no mention of him in his works nor does Eysenck mention any contributions from the Georgians. However, both use similar terminology (Eysenck, 1947, 28; Uznadze, 1966, 49). It is the purpose of this study to examine the performance on Uznadze set tasks of introverts and extraverts, neurotics and stable, hysterics and dysthymics as differentiated on the Eysenck Personality Inventory. Each subject is tested individually to determine the number of trials required to fixate and to extinguish a set in the visual and haptic modalities, to irradiate a set from the haptic to the visual modality, and to extinguish the irradiated set in the visual modality. This will make it possible to compare the meaning of terms such as extravert, choleric and melancholic used by Eysenck (1947) and Norakidze (1958, 1966) and to compare the performance on Uznadze set tasks of hysterics and dysthymics, neurotics and stable, introverts and extraverts.

II. THE CONTRIBUTIONS OF EYSENCK TO THE PROBLEM

The core of Eysenck's view of psychology is derived from his conviction that measurement is fundamental to all scientific advance and that factor analysis is the most useful instrument for pursuing this goal. Also implicit in Eysenck's work is the conception of personality

as composed of acts and dispositions that are organized in a hierarchical fashion in terms of generality and importance (Hall and Lindzey, 1957, 384).

Specific reactions, the least general, are grouped into more general habits, which in turn yield a trait. Several traits overlap to yield second-order factors which Eysenck denotes as types (Eysenck, 1947, 30). Consequently, introversion as a type enters to some extent into different traits, such as shyness and anxiety.

In factor analysis there are four types of factors: error factors which are present only on one occasion but not on others; specific factors which are peculiar to a single test or trait whenever it occurs; group or primary factors, common to certain tests or traits but absent in others; general or second-order factors common to all the tests or traits used in an investigation (Eysenck, 1960, 14).

Eysenck defines personality as:

. . . the sum total of the actual or potential behavior-patterns of the organism, as determined by heredity and environment; it originates and develops through the functional interaction of the four main sectors into which these behavior-patterns are organized: the cognitive sector (intelligence), the conative (character), the affective sector (temperament), and the somatic sector (constitution) (Eysenck, 1947, 25).

Since the late 1940's, Eysenck has been working on the refinement of a theory of personality which assumes that personality is accurately quantifiable. Such quantification leads primarily to the almost completely uncorrelated continuous dimensions of personality, namely, introversion-extraversion and neuroticism-stability. In addition, Eysenck combines the extravert-neuroticism dimensions to form the hysteric group and the introvert-neuroticism dimensions to form the dysthymic group (Eysenck, 1957).

While the existence of clear-cut, unidimensional and uncorrelated factors have not been equivocally demonstrated (Carrigan, 1960; Hamilton, 1957; Sigal, Star and Frank, 1958), there seems to be sufficient evidence of their validity to warrant their use in the present experimental study.

Eysenck's dimensions are largely due to a synthesis of a small part of Jung's theory of personality and of Pavlov's parameters of higher nervous activity. For Jung, libido oriented toward external world or inner world results in extraversion and introversion respectively. Pavlov (1927) concludes that organisms differ physiologically on the basis of characteristics of the nervous system, such as strength, mobility, and balance between excitation and inhibition. While Jung's typology has retained its popularity (Carrigan, 1960), Pavlov's theory was largely ignored until fairly recently (Simon, 1957). Experimental work is now being done in the U.S.S.R. to quantify, elaborate and delimit Pavlov's theory (Gray, 1964).

Eysenck (1964, 9) states the relationship between constitutional and behavioral aspects of extraversion-introversion as follows:

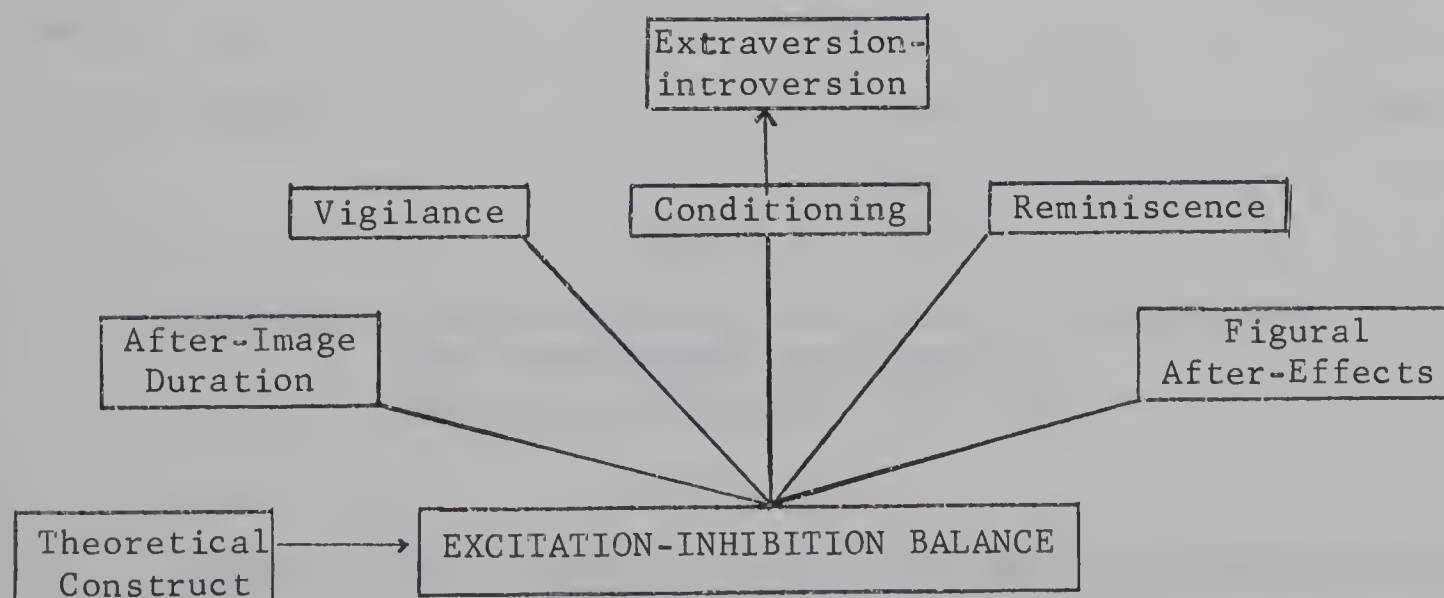


FIGURE 3

RELATIONSHIP BETWEEN CONSTITUTIONAL AND
BEHAVIORAL ASPECTS OF EXTRAVERSION

Figure 4 lists some of the characteristics experimentally found to exist with the dimension of extraversion-introversion. For example, extraverted subjects, compared with introverts, perform differently on various tasks; characteristics, such as attitudes, also differ between the two groups.

TASKS AND CHARACTERISTICS	INTROVERT	EXTRAVERT
Intellectual function	Low IQ/vocab. ratio	High IQ/vocab. ratio
Perceptual rigidity	High	Low
Persistence	High	Low
Speed	Low	High
Speed/Accuracy ratio	Low	High
Level of aspiration	High	Low
Intra-personal variability	Low	High
Sociability	Low	High
Repression	Weak	Strong
Social attitudes	Tender minded	Tough minded
T.A.T.	Low productivity	High productivity
Conditioning	Quick	Slow
Stress reaction	Over active	Inept

FIGURE 4

DIFFERENCES BETWEEN EXTRAVERTS AND INTROVERTS WHICH HAVE
BEEN DEMONSTRATED EXPERIMENTALLY
(Adapted from Eysenck, 1957, 28)

Eysenck (1963) supports the view that the neuroticism factor is closely related to the autonomic nervous system, while the extraversion factor is closely related to the degree of excitation and inhibition prevalent in the central nervous system.

In line with this, Eysenck states two important postulates. The first of these, the Postulate of Individual Differences, is as follows:

Human beings differ with respect to the speed with which excitation and inhibition are produced, the strength of the excitation and inhibition produced, and the speed with which inhibition is dissipated (Eysenck, 1957, 114).

Eysenck calls the second postulate the Typological Postulate.

Individuals in whom excitatory potential is generated slowly and in whom excitatory potentials so generated are relatively weak, are thereby predisposed to develop hysterical-psychopathic disorders in cases of neurotic breakdown; individuals in whom excitatory potential is generated quickly and in whom excitatory potentials so generated are strong, are thereby predisposed to develop dysthymic patterns of behavior and to develop dysthymic disorders in case of neurotic breakdown (Eysenck, 1957, 114).

Excitation, Inhibition and Figural After-effects in Hysterics and Dysthymics

Eysenck proposes the following relationships with regard to personality dimensions:

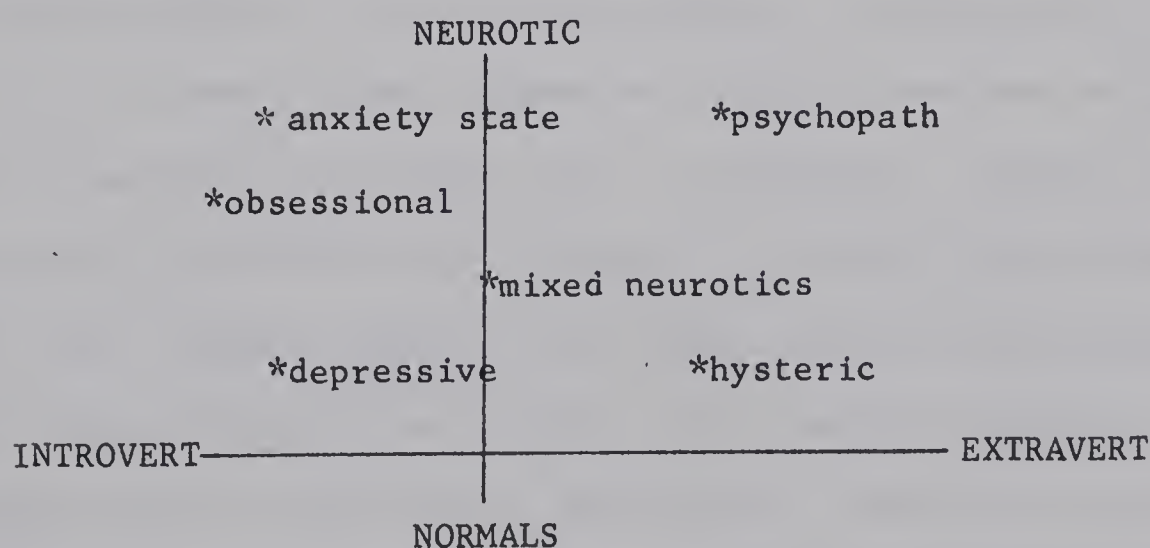


FIGURE 5

SEVERAL LOCATIONS OF NEUROTIC INTROVERTS AND EXTRAVERTS
WITH REGARD TO EYSENCK'S PERSONALITY DIMENSIONS
(Adapted from Eysenck, 1957, 30)

The psychopaths and the hysterics comprise the hysteric group

(neurotic extraverts) while the anxiety states, reactive depression and obsessionals comprise the dysthymic group (neurotic introverts). Descriptively, dysthymics tend to develop anxiety and depression symptoms; they are rigid, show little personal variability, and tend to be very self-conscious. Dysthymics also have feelings of inferiority. Hysterics show little energy, have narrow interests and lack persistence. They are quick, not very rigid and show great intrapersonal variability (Eysenck, 1947).

Whenever any stimulus-response connection is made in an organism (excitation) there also simultaneously occurs a reaction in the nervous structure mediating this connection which opposes its recurrence (inhibition). Pavlov considers the hysteric to be closely linked with the concept of inhibition. He postulates excessive concentration of excitation in nervous systems with the process of negative induction giving rise to intense inhibition in hysterics (Eysenck, 1955).

Eysenck predicts that satiation effects (localized inhibition) should, in the hysteric group, appear more quickly and more strongly and should disappear more slowly than in dysthymics. Eysenck concludes that the strong inhibitory type (extravert, hysteric) should display sluggish, inert response behavior; the weak inhibitory type (introvert, dysthymic) should display over-active, over-responsive behavior. Introverts (the active response type) tend to show anxiety, while the extraverts (the inert response type) tend to show emotional indifference (Eysenck, 1955).

With regard to figural after-effects, Eysenck believes that original stimulation sets up certain unspecified cortico-neural events which the individual perceives as illusions. These cortico-neural events produce

inhibition in the structures mediating the effects so that eventually the after-image is halted. The amount of inhibition produced is proportional to the subject's position on the extraversion-introversion continuum, such that more inhibition as measured by the short duration of after-image would be expected in the hysteric -psychopathic, the extraverted and the brain damaged groups (Eysenck, 1955).

Eysenck supports the conclusion that kinesthetic figural after-effects in the hysteric group appear more quickly, are more strongly marked and disappear more slowly than in the dysthymics (Eysenck, 1955).

Claridge (1960) finds that some individual differences in group comparisons can be attributed fairly confidently to a personality factor identifiable as extraversion. Furthermore, the factor bears a systematic relationship to performance on objective tests in which central inhibition is postulated as a relevant underlying variable. Claridge concludes that inhibition, as an explanatory concept, has general applicability to different measures of behavior.

Holland takes a critical look at Eysenck's work with figural after-effects. He says:

It has been repeatedly observed that there are individual differences in the components of figural after-effects; for example, magnitude, ease of elicitation and resistance to decay. Few studies, however, have deliberately investigated these differences (Holland, 1960, 217).

Temperament

As a term, temperament originated in the Middle Ages with the doctrine of the four humors. They were originally derived from Empedocle's assertion in the fifth century B.C. that all nature is composed of four elements: earth, air, fire, and water. In the fourth century B.C. Hippocrates claimed that the macrocosmic formula must have its microcosmic

reflection in man's make-up in the form of the four "humors." According to Galen, one's temperament is determined by the dominant humor. The four humors and their corresponding temperaments are: blood (sanguine or hopeful), black bile (melancholic or sad), yellow bile (choleric or irascible) and phlegm (phlegmatic or apathetic). For Eysenck, temperament is defined as an individual's "more or less stable and enduring system of affective behavior (Eysenck, 1960, 2)."

Eysenck makes references to Wundt who grouped the four temperaments by contrasting the quick (extraverted) with the slow (introverted), the strong (emotional) with the weak (non-emotional). In Eysenck's terminology, the hysteric would emerge as the choleric, the dysthymic as the melancholic, and the non-neurotic extraverts and the introverts as the sanguine and phlegmatic respectively (Eysenck, 1964, 6).

Figure 6 shows the relationship between the extraversion-introversion and neuroticism dimensions and the ancient Galen scheme of the four temperaments.

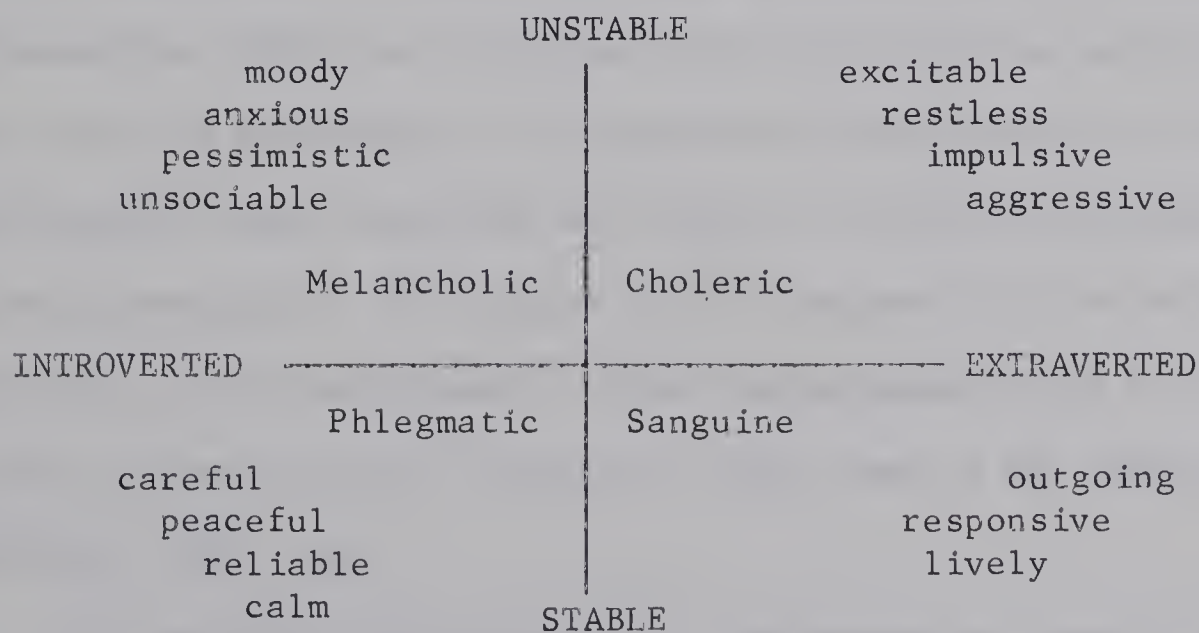


FIGURE 6

RELATIONSHIP OF EXTRAVERSION/INTROVERSION
NEUROTICISM/STABILITY AND TEMPERAMENTS
(Adapted from Eysenck, 1964, 6)

For the most part, Eysenck's work is well supported by British research (Broadbent, 1958; Franks, 1956; Lynn, 1959, 1961; Lynn and Gordon, 1961), but not so well by American research (Becker and Matterson, 1961; Edwards, 1955; Edwards and Walker, 1962; Gelford and Winder, 1961; Rechtschaffer, 1958; Taylor, 1961).

Eysenck has tentative support from Anderson (1962), Cattell (1959), Cattell and Scheider (1961), and Couch and Keniston (1960). Carrigan (1960), in a detailed and comprehensive review of the literature, concludes that the unidimensionality of extraversion-introversion has not been unequivocally demonstrated and that a clear-cut answer to the question of whether extraversion-introversion is independent of adjustment is not yet possible.

III. THE CONTRIBUTION OF NORAKIDZE TO THE PROBLEM

One branch of Soviet psychology, the psychology of set, is directly concerned with the psychology of personality. Uznadze (1961) and Norakidze (1966) are concerned with the living man and his relationships with the environment. To understand psychological activity, psychologists must understand the subject, the whole individual, that is, the personality. One cannot divorce personality from either the individual or the environment. Other psychologies think of personality in terms of psychological processes rather than as the subject as a whole (Norakidze, 1958, 348).

For Norakidze personality is a comprehensive concept which includes a definite social category. Personality develops through the process of human interaction and communication; personality is the totality of social relationships while mental processes and their

characteristics are the instrumentality for effecting these relationships. Man, as a whole, is not the sum of physical and mental elements but is a living being which relates to the environment. Personality is present in every given moment as the subject of activity, while the set is the basis of the activity (Norakidze, 1958, 1966).

Method of Study

For the study of personality and set characteristics Norakidze chose 225 subjects. He began an intensive investigation by the following means: biographical studies, clinical interviews, observation, analysis of work habits and a study of some diaries. Norakidze was able to establish the basic needs of each individual, his aims and attitudes. He was also able to investigate the subjects' emotionality, impulsivity, temperament, and whether the willed acts were in harmony or in conflict with impulsive activities (Norakidze, 1966, 42).

After completing his study of subjects, Norakidze was able to distinguish three distinct types of individuals which he labelled as harmonious, conflictive and impulsive. Of the 225 subjects chosen, 150 were able to continue participation in the experiment. Norakidze conducted set tests in the visual, haptic and kinesthetic modalities and noted the characteristics of each individual's set. The results of Norakidze's investigation are given in the following sections.

Harmonious Type

Norakidze describes the harmonious type as individuals who believe in the beauty of life, possess high aims, love and happiness, orient to new situations and never demand to be the centre of attention. They are able to overcome impulsive behavior, objectivate a situation

and proceed on the basis of their will; a set develops in accordance with a changed situation (Norakidze, 1966, 52).

In experimental situations, one or two set trials do not develop a strong set. Therefore, this person is not easily influenced by every situation. The individuals may be indifferent to many instances in life but they are able to attain their goals through an application of their abilities. The dynamicity of set allows this individual to control his impulsivity and to switch to a new set and its concomitant behavior without obvious conflict. The plasticity of set is shown by its gradual extinction, which in turn is reflected in the subject's behavior of never starting or finishing business at once (Norakidze, 1958, 361).

With regard to set characteristics, Norakidze notes that the subjects investigated possess a plastic-dynamic set in 85% of cases with a weakly irradiated set in the visual sphere. Dynamic set accounted for 99% of the cases and plastic set for 86% in the haptic sphere. Thus, the most important set characteristics were set plasticity and dynamicity. In addition set also tends to be stable. During a five day period, stability in the visual sphere was displayed in 84% of the subjects and in 90% of the subjects in the haptic sphere (Norakidze, 1958, 362).

Conflictive Type

Generally, the 31 individuals in this group are characterized by some divergence in the impulsive and the objective plane. Subjects are characterized by excessive sensitivity but possess the ability to check internal impulses and to regulate their outward conflicts. Experiences

are deeply conflictive but outwardly the individual appears to be in harmony with his environment (Norakidze, 1958, 373).

Although social motives may be present, many acts tend to be individualistic in nature. In order to harmonize his behavior with the demands of the environment, this individual has to employ will, imagination and objectivization. The subject is withdrawn and would rather be alone than engage in social interaction (Norakidze, 1966, 87).

Decision making poses some difficulty for this person. He is fully aware of the problem but he does not trust the situation in which he finds himself. During such times, this individual is internally conflictful and feels an urgency to fulfill the decision. After making the decision he expends energy to carry out the solution, but the switch to the second plane of behavior is often disturbing. People of this type often succumb to impulsive behavior but usually are aware of what they are doing (Norakidze, 1966, 85).

Because set has static properties, the individual has difficulty in freeing himself from the influence of impulses of the moment. Only when incidents in situations change and demand other forms of behavior does a new set emerge. The changing of sets demands special forces from the individual; one often needs help to change sets in new situations (Norakidze, 1958, 376).

Norakidze notes that in conflictive subjects set is easily excitable, often requiring only two to five set expositions for the development of a strong set. Once fixated, set tends to be static and rigid. Static set accounts for 57% of the characteristic type in the visual sphere and 99% in the haptic sphere. In 28% of the subjects, set did not fixate with ease, but when it did, it tended to be rigid,

static and strongly irradiated. All subjects are able to develop a strong set on the basis of imagination. Set tests of quality also tend to be static (Norakidze, 1966, 101).

Impulsive Type

Norakidze notes that one group of 19 subjects in the impulsive group have a strong tendency to act on the first plane of behavior, that is, behavior tends to emerge on the basis of impulsivity. Behavior is conditioned by the type of sets that are prevailing at the given moment (Norakidze, 1966, 108).

Individuals can often objectivate their impulsive behavior since they are aware of their behavioral aims, but they have great difficulty in freeing themselves from the impulses of set. In experimental situations it is possible for individuals to objectivate their impulsive behavior, but the change from the first to the second plane of activity is difficult.

Norakidze (1958) was able to note a second group of 29 individuals who differed from the first impulsive group. This type is hard to please, often bitter, and emotionally labile. The individual has no stable characteristics because personality characteristics do not appear to emerge from 'within' but rather reflect the situations in which the individual finds himself. Many emotions, such as depression, happiness, boredom, are superficial and short-lived, without any real basis for their appearance. Individuals often struggle for definite ideas, but even when they are able to think or objectivate, they have no genuine belief in their ideas.

Impulsive persons usually do not develop core motives or values. Their life is guided not by will, but by compulsion arising from the

situation. An impulsive individual is restless and in the absence of definite individual aims behavior is determined by social needs and goals. These individuals prefer to be with other people (Norakidze, 1958, 378).

Uznadze speaks of this type of individual in the following manner:

The individual in which a given quantity of set trials does not result in the appearance of illusions, will always perceive the equal spheres in the correct manner. Conditions which result in the fixation of set in other individuals, do not appear sufficient for the emergence of a strong set. We have to think that in this case we are dealing with people who are directed by a complete lack of internal sources of strength and instead are directed by the external influences. Such people are characterized by maximum extravertness (Uznadze, 1961, 35).

Set in the first group tends to be variable and stable. Stability is stronger in the haptic sphere than in the visual modality. Fixated set produces 14 to 24 illusions but approximately 31% of the subjects do not fixate (Norakidze, 1966, 120).

In 82% to 96% of the cases in the second group, set is variable and labile; in 35% of the cases set does not fixate. Set which does fixate is usually local in nature, with little irradiation (Norakidze, 1958, 379).

Set and Temperament

In his work on temperament Norakidze worked intensively with 59 men. They were chosen from an original 153 subjects by biographical study, clinical interviews and observations. For Norakidze, temperament is a physiological and psychological phenomenon expressed in the basic impulsive-emotional aspects of man (Norakidze, 1958, 348).

Subjects of sanguine temperament require 5-10 trials for set fixation and predominantly exhibit contrast illusions. During extinction

set tends to be plastic and dynamic. Only in the visual modality is set weak. In the transfer of set from the haptic to the visual modality, set irradiation gives only one or two illusions. If one increases the number of set presentations the characteristics of the set pattern do not change. An individual does not remain under the influence of emerging, impulsive behavior; fixated set extinguishes and a new set emerges in accordance with the given situation (Norakidze, 1958, 350).

Subjects of phlegmatic temperament fixate with difficulty. When a set does fixate, it tends to be rigid-dynamic in nature. Compared to the sanguine, the phlegmatic has low set excitability, which accounts for the emotional-impulsive activities characteristic of such people. For fixation to occur it is necessary to have strong stimuli or repeated presentations of stimuli. A person with low excitability of set is also characterized by inertness and by the emergence of impulsive-emotional activity. However the inertness never becomes pathological. A rigid-dynamic set makes the appearance of a new set more difficult. Consequently, a person with phlegmatic temperament has difficulty in changing from one activity to another (Norakidze, 1958, 351).

Subjects with a choleric temperament are noted for high excitability in the kinesthetic and haptic spheres and low excitability in the visual sphere. Set in the haptic sphere is rigid and local in nature. In the visual modality set is comparatively weak and one is often not fixated (Norakidze, 1958, 353).

Impulsive behavior in this group is characterized by high excitability; reactions emerge quickly. For set fixation few trials are required. In the visual modality where the fixation of set is characterized by lower excitability, few trials are required as compared with

the phlegmatic.

For subjects of the melancholy temperament, set excitation occurs with great difficulty; if a set does form, it tends to be static. Irradiation may occur in these subjects, although the irradiated set also tends to be static (Norakidze, 1958, 354).

Norakidze (1958, 1966) emphasizes that a comparison of the types of higher nervous activity and types of set reinforces the fact that the physiological basis of fixated set reflects different types of nervous activity. For example, the characteristics of plastic-dynamic set coincide with Pavlov's concept of types of nervous activity in the sanguine temperament. The physiological basis of a plastic-dynamic set appears to be a type of nervous system characterized by excitation and inhibition, a dynamic process of extinction, equilibrium in systems of excitation and inhibition and ease of mobility.

The fixated set of the phlegmatic excites with difficulty and tends toward inertness. The corresponding Pavlovian type is a nervous system characterized by strong processes of excitation and inhibition, excessive equilibrium of given processes (excitation and inhibition) and difficulty of transfer from one stereotype to another.

In the choleric type, set appears to be easily excitable, very rigid, either dynamic or static and local. The correlative physiological basis is an easily excitable, unbalanced, impetuous nervous system.

Eysenck and Norakidze - A Comparison

A theoretical relationship in the literature appears to exist among Eysenck, Norakidze, Teplov and Pavlov. The hysteric and dysthymic types described by Eysenck and the impulsive and conflictive types of Norakidze appear very similar phenotypically. Although Eysenck often

does not distinguish very carefully among dysthymics, hysterics, introverts and extraverts, it appears that the hysterics and the dysthymics are in fact neurotic extraverts and neurotic introverts, respectively (Eysenck, 1947). The descriptions of some personality types by Norakidze (1958) appear to be related to the dysthymics and the hysterics. If in fact Norakidze (1958) and Uznadze (1961) think in terms of three major personality types--the impulsive, the conflictive and the harmonious--it would appear then that the conflictive and the impulsive are comparable with Eysenck's dysthymics and hysterics.

The temperament relationship may be a semantic similarity only. Both Eysenck's and Norakidze's theories stem from the work of Galen and Wundt. The basic problem is that Eysenck does not give sufficient experimental evidence for his arrangement of the four temperaments. According to Figure 6, p. 78, the unstable extravert or hysteric would correspond to the choleric temperament, while the unstable introvert or dysthymic would correspond to the melancholic temperament. Unlike Eysenck, Norakidze has related temperament to set characteristics.

Both Eysenck (1957, 1963) and Norakidze (1958) express interest in Pavlovian theorizing as the physiological basis for their work. Eysenck's postulates stress the importance of excitation and inhibition (Eysenck, 1957). The excess of either excitation or inhibition and their balance or imbalance are some of the basic physiological processes differentiating extraverts and introverts.

Both Eysenck and Norakidze think of personality in a holistic manner. With the former, personality is behavior; with the latter, a whole acting individual. Whereas Eysenck conceptualizes a hierarchical structure from specific responses to types derived by factor analysis,

Norakidze derives his typology from clinical interviews and observations.

In summary, the works of Eysenck and Norakidze have similarities. From Eysenck's dimensions of personality, the hysterics and the dysthymics correspond to the choleric and melancholic temperaments. Norakidze's conflictive and impulsive groups have set characteristics similar to the melancholic and choleric temperaments. The conflictive and impulsive groups have characteristics similar to the dysthymic and hysteric groups. Since Eysenck (1955) found that hysterics and dysthymics have different figural after-effects, which are similar to illusions of set (Bzhalava, 1962) it is possible to state several postulates and testable hypotheses.

IV. POSTULATES AND HYPOTHESES

A. Postulates

1. The theory of Eysenck and Uznadze both relate to the theory of Pavlov. Norakidze relates set characteristics to individual processes of the nervous system, such as excitation and inhibition (Norakidze, 1958). Similarly, Eysenck employs Pavlovian theory of inhibition to explain hysteric and dysthymic characteristics (Eysenck, 1952, 1957).

2. Even though both Eysenck and Norakidze derive definitions of some personality types such as impulsive, conflictive (Norakidze, 1958), dysthymic, hysteric (Eysenck, 1955, 1963), in a different manner, the descriptions of phenotypes are very similar. If Eysenck and Norakidze are talking about the same types, then the hysterics and the dysthymics as differentiated on the Eysenck Personality Inventory should perform on Uznadze set tasks as described by Norakidze.

3. If the performance of the hysteric on set tasks is similar to his performance on kinesthetic tests described by Eysenck (1955) and

his behavior is similar to the impulsive personality type, the set in the test subject should fixate readily, extinguish with difficulty and irradiate from one modality to another (Eysenck, 1947, 1955, 1963; Norakidze, 1958; Prangishvili, 1962; Uznadze, 1958, 1961).

4. The conflictive personality type is similar to the dysthymic in many phenotypic aspects. On the set tests, the test subject is able to objectivate a situation and has difficulty in fixating a set. When a set does fixate, it exists for a short period of time, with no irradiation (Eysenck, 1947, 1955; Norakidze, 1958, 1966).

5. Although both Eysenck and Norakidze use the four temperaments in their theory discussions, they appear to be secondary in Eysenck's theory but to be of more importance to the theory of Norakidze.

6. Both Uznadze and Eysenck use the term "extravertive" in their theory.

The performance on set tasks of hysterics and dysthymics form the major hypotheses. Both Eysenck and Norakidze employ the term 'extravert', who, according to Uznadze (1961) does not fixate in a given experimental situation; thus set irradiation is not investigated in the introverts and extraverts. In addition, since Norakidze does not discuss introverts, neurotics and the stable, their performance on set tasks form the minor hypotheses.

B. Hypotheses

Major Hypotheses

Hysterics in comparison with dysthymics as differentiated by extreme scores on the E.P.I. will:

1. fixate a set in the haptic modality in fewer trials;
2. require a larger number of trials to extinguish a set in the haptic modality;
3. fixate a set in the visual modality in fewer trials;
4. require a larger number of trials to extinguish a set in the visual modality;
5. require a smaller number of trials to transfer a set from the haptic modality to the visual modality;
6. require a larger number of trials to extinguish an irradiated set in the visual modality.

Minor Hypotheses

1. Neurotics will differ from the stable subjects with regard to set characteristics.
2. Introverts will differ from extraverts with regard to set characteristics.

Testable Hypotheses

1. H_0 : There is no difference between hysterics and dysthymics in the number of set trials needed for the fixation of a set in the haptic modality.
 H_1 : Hysterics, compared to dysthymics, require a smaller number of trials for set fixation in the haptic modality.
2. H_0 : There is no difference between hysterics and dysthymics in the number of critical set presentations needed to reach veridical perception in the haptic modality.
 H_1 : Hysterics, compared to dysthymics, require a larger number of trials to extinguish a set in the haptic modality.
3. H_0 : There is no difference between hysterics and dysthymics in the number of set trials needed for the fixation of a set in the visual modality.
 H_1 : Hysterics, compared to dysthymics, require a smaller number of trials for set fixation in the visual modality.
4. H_0 : There is no difference between hysterics and dysthymics in the number of critical set presentations needed to reach veridical perception in the visual modality.
 H_1 : Hysterics, compared to dysthymics, require a larger number of critical set presentations for set extinction in the visual modality.

5. H_0 : There is no difference between hysterics and dysthymics in the number of set trials in the haptic modality required to transfer a set to the visual modality.
 H_1 : Hysterics, compared to dysthymics, will require a smaller number of set trials for inter-modal transfer.
6. H_0 : There is no difference between hysterics and dysthymics in the number of critical set presentations needed for the extinction of an irradiated set in the visual modality.
 H_1 : Hysterics, compared to dysthymics, will require a greater number of critical set presentations for irradiated set extinction in the visual modality.
7. H_0 : There is no difference between neurotics and the stable with regard to set fixation and extinction in the haptic and visual modalities and set irradiation from the haptic to the visual modality.
 H_1 : Neurotics, compared to stables, will require a greater number of trials for set fixation, extinction and set irradiation from the haptic to the visual modality.
8. H_0 : There is no difference between introverts and extraverts with regard to set fixation and extinction in the haptic and visual modalities.
 H_1 : Extraverts compared to introverts will require a greater number of trials for set fixation and extinction.

V. THE SAMPLE

During the months of June, July, and August, 1966, 122 first year student nurses at the University, Royal Alexandra, General and Misericordia Hospitals in Edmonton participated in the experimental study. The sample of 122 included: University of Alberta Hospital, 40 subjects; Royal Alexandra Hospital, 15 subjects; Misericordia Hospital, 30 subjects; General Hospital, 37 subjects.

VI. THE INSTRUMENTS

Eysenck Personality Inventory

The Eysenck Personality Inventory (E.P.I.) (Appendix B) is a further development in the measurement of dimensions obtained from

the Maudsley Personality Inventory (M.P.I.). Like the M.P.I., the E.P.I. measures two major dimensions of personality, extraversion-introversion (E) and neuroticism-stability (N), as well as the hysteric (neurotic extravert) and the dysthymic (neurotic introvert) groups. The E.P.I. consists of 57 "yes" and "no" questions which yield extraversion, neuroticism and lie scores. Any subject with a lie score greater than 5 is not used for further experimentation. The advantages of using the E.P.I. are: it consists of 2 parallel forms; the items have been reworded so that they can be used by subjects of low intelligence or education; suitable item selection has resulted in no correlation between the extraversion and neuroticism scores; the retest reliability is in excess of .85; direct evidence is available for the validity of the E.P.I. as a descriptive instrument of the behavioral manifestations of personality (Eysenck, 1964, 10-20).

Set Equipment

The following material was used for the set experimentations:

1. A tachistoscope.
2. Two slides. One slide with two circles; a right circle 30 mm in diameter and a left circle, 15 mm in diameter. The second slide contained two circles, each 22.5 mm in diameter. Each circle consisted of a black line on a white background.
3. Three wooden spheres with handles. One sphere was 100 mm in diameter, the other two were each 70 mm in diameter. The weights of each of the spheres was 300 grams.

The set equipment used for the experiment is similar to the specifications (dimensions and materials) described by Prangishvili (1958, 251-275). The instructions for administering the set tests are found in Appendix D.

VII. THE PROCEDURE

The gathering of data involved two phases, group testing and individual testing. For the group testing, arrangements were made with the Directors, Supervisors and Teachers to visit the various classes of student nurses to administer the written instrument. At such times the subjects were asked for their cooperation in a two-part experiment and briefly informed of its nature. Each subject was then given the E.P.I. and asked to mark an "X" under either the "Yes" or the "No" column for each statement that best described her. There was no time limit for test completion.

After each subject completed the E.P.I., the E, N, and L scores were determined. If the lie score was below 5, extreme N and E scores were used to plot the individual's position on Eysenck's personality dimensions (Figure 7, p. 94 and Table II, p. 95). Individual appointments were made for the second phase of the experiment. The Supervisor provided rooms at each residence for individual testing. Mr. Raymond Hertzog, a graduate student and collaborator, presented the set objects for each subject while the writer recorded responses made by each subject.

Each individual was tested for set characteristics; however, only an equal number of individuals with extreme scores in the following groups were used for statistical analyses: the hysterics and dysthymics; the introverts and extraverts; the stable and the neurotics.

TABLE II

MEANS AND STANDARD DEVIATION OF EXTRAVERSION
AND NEUROTICISM SCORES USED IN ANALYSIS

TYPE	MEAN		STANDARD DEVIATION		SAMPLE SIZE
	E*	N**	E	N	
Hysteric	16.90	14.40	2.17	1.58	16
Dysthymic	7.45	16.31	2.64	2.76	16
Stable	12.50	4.16	.50	1.34	7
Neurotic	12.33	17.66	.92	2.35	7
Extravert	17.83	10.10	1.95	1.06	6
Introvert	6.66	10.33	2.28	.74	6

*Extraversion

**Neuroticism

VIII. PROCEDURE RELATED TO TESTABLE HYPOTHESES

On the basis of extreme scores on the E.P.I. (Table II, p. 95), the following groups of subjects were differentiated: hysterics and dysthymics; extraverts and introverts; stable and neurotics. Each hysteric and dysthymic subject was observed for the number of trials required to (1) excite and extinguish a set in the haptic modality; (2) excite and extinguish a set in the visual modality; (3) irradiate a set from the haptic to the visual modality; (4) extinguish an irradiated set in the visual modality. The neurotics and the stable were observed for the number of trials required to (1) excite and extinguish a set in the haptic modality; (2) excite and extinguish a set in the visual modality; (3) irradiate a set from the haptic to the visual modality. The extraverts and the introverts were observed for the number of trials required to (1) excite and extinguish a set in the haptic modality; (2) excite and extinguish a set in the visual modality. Each subject was categorized according to the number of trials that were required to fixate and extinguish the set (excitation and fixation are used synonymously).

The following a priori categories of trials were used: 1-2, 3-5, 6-10, 11-15, 16-19 and 20+ for both excitation and extinction trials; for extinction, an additional category '0' was used. For example, if a subject established a set in 2 trials, she was placed in the category '1-2,' or if she extinguished a set in 7 trials, she was placed in the category '6-10.' If she did not fixate or extinguish a set in 19 trials, she was placed in the '20+' category. In actual practice, 25 trials for excitation and 30 trials for extinction of set were selected as the cut-off points. The assumption is that if a set had not fixated in 25 trials

an infinite number of set tests are required to fixate the set; if set did not extinguish in 30 trials, an infinite number of critical tests are necessary to extinguish the set (Uznadze, 1958).

The '0' category refers only to extinction in the visual modality. For experimental purposes, subjects who did not fixate a set in 25 trials did not have a set present to extinguish.

Sixteen hysterics and 16 dysthymics were tested to validate the hypotheses on set fixation, extinction and irradiation. The procedure was as follows:

1. a. A subject momentarily grasped 2 spheres, unequal in size but similar in weight for two trials (set tests).
- b. The subject momentarily grasped 2 spheres, equal in size and weight (critical test) immediately after the second set test.
- c. If the subject perceived the equal spheres as equal during the critical test, it was assumed the subject did not form a set; no illusion was present.
- d. The set tests (unequal spheres) were presented for three additional trials.
- e. Following the 5th set test, the unequal spheres were again presented to the subject.
- f. If the subject said the spheres were unequal, then set had fixated because an illusion was present.
- g. The subject was recorded in the category of trials '3-5'. (For a more detailed description of the method of presentation see Appendix D).
- h. If in (f) the subject still perceived the equal spheres as equal, additional set tests were conducted, with critical tests following the 10th, 15th and 19th trials (Table I, p. 154; Appendix E).
- i. There was a maximum of 25 set tests.
2. When the subject perceived the two equal spheres as unequal, the critical tests were continued until the equal spheres were perceived as equal by the subject; that is, until no illusion was present or until the maximum number of 30 trials was reached (Table II, p. 154).

3. A subject viewed two unequal circles shown briefly in a tachistoscope. After two setting trials, two equal circles were shown briefly. If the two circles appeared equal to the subject, the set tests were continued. The identical procedure as in (1) was conducted using circles instead of spheres (Table III, p. 155).
4. When the subject perceived the two equal circles as unequal, the critical tests were continued until there was veridical perception or the maximum 30 extinction trials (Table IV, p.156).
5. A subject momentarily grasped two unequal spheres (set tests) for 2 trials; following the second trial, 2 equal circles were shown in the tachistoscope. Again, the same alternating procedure as (1) above was conducted using spheres and circles (Table V, p. 156).
6. When the subject perceived the two equal circles as unequal the critical tests were conducted until perceptual veridicality was reached or a total of 30 trials (Table VI, p.157).

Seven neurotics and 7 stable were selected for set tasks.

7. Set objects (spheres and circles) were presented to each subject to determine the number of trials required for set fixation and extinction in the haptic and visual modalities. The number of trials required for set transfer from the haptic to the visual modality was also noted. (Tables VII, VIII, IX, X, XI, pp. 158-160).

Six introverts and 6 extraverts were selected for set tasks.

8. Subjects were presented set objects to determine the number of trials required for set fixation and extinction in the haptic and visual modalities (Tables XII, XIII, XIV, XV, pp. 160-162).

Variables

1. For this sample the control variables are:

Age: all subjects used were 18-19 years of age with a mean age of 18.8 years.

Sex: only female subjects were used.

2. For this research the independent variables are subjects differentiated on the basis of the E.P.I. These include:
 - a. sixteen dysthymics and 16 hysterics;
 - b. seven stable and 7 neurotics;
 - c. six introverts and 6 extraverts.

3. For this research the dependent variables are as follows:
 - a. the number of trials required to excite a set in the haptic modality;
 - b. the number of trials required to extinguish a set in the haptic modality;
 - c. the number of trials required to excite a set in the visual modality;
 - d. the number of trials required to extinguish a set in the visual modality;
 - e. the number of trials required to transfer a set from the haptic to the visual modality;
 - f. the number of trials required to extinguish the irradiated set.

IX. STATISTICAL ANALYSES

The following three separate comparisons are made in this study:

1. The performance of hysterics and dysthymics on Uznadze set tasks.
2. The performance of stable and neurotics on Uznadze set tasks.
3. The performance of introverts and extraverts on Uznadze set tasks.

Nonparametric statistical tests are used in the analysis of data.

The tests used are:

1. Kolmogorov-Smirnov two-sample test (Siegel, 1956, 128-129).
2. Spearman rho (Siegel, 1956, 202-213).

Nonparametric tests are used since they do not require the assumptions for a t-test (interval measurement, homoscedasticity, normality of distribution). According to Siegel, nonparametric tests have the following advantages:

1. The tests are easy to learn and to use.
2. There are statistical tests for treating samples made up of observations from several different populations.

3. Exact probabilities may be obtained regardless of the population distribution.
4. For samples as small as $N=6$, nonparametric statistics must be used unless the nature of the population distribution is known exactly.
5. Nonparametrics can be used where grouping of data is used (Siegel, 1956, 32-33).

The Kolmogorov-Smirnov two-sample test (Siegel, 1956, 127) is a powerful test used to determine whether two independent samples have been drawn from the same population. A cumulative frequency distribution is made for each sample of observations, using the same interval for both distributions. The test focuses on the largest of the observed deviations (D value). The procedure is described in Siegel (1956, 128-129). A one-tailed test is used since the direction of prediction is included in the hypotheses.

The Kolmogorov-Smirnov test for statistical significance is chosen for the following reasons:

1. When compared to the t -test, the Kolmogorov-Smirnov test has high power efficiency for small samples (about 96%). The power of a test is defined as the probability of rejecting H_0 when it is in fact false.
2. The Kolmogorov-Smirnov two-sample test for independent samples employs categories which may be narrow or broad, as long as they are the same for both samples.
3. The Kolmogorov-Smirnov test is more powerful than either the Chi square test or the median test.
4. Since two independent samples are to be compared with regard to performance on set tasks, it is possible to test for statistical significance using the Kolmogorov-Smirnov test by using larger or small samples, a .01 or a .05 level of significance, and a one or a two-tailed test (Siegel, 1956, 47-51).

Test for Reliability

The Spearman ρ is a nonparametric measure of correlation based on ranking.

In order to ascertain the stability of the set characteristics a test-retest reliability check was done using the Spearman rho (Siegel, 1956, 219). Of the 122 subjects used in this study, 25 were selected by means of a table of random numbers and retested one week after the first set tests were given. The categories used for the ranking were 0, 1-2, 3-5, 6-10, 11-15, 16-19 and 20+ trials. The Spearman correlations obtained were:

1. fixation in the haptic modality: 0.98
2. fixation in the visual modality: 0.98
3. extinction in the haptic modality: 0.98
4. extinction in the visual modality: 0.99
5. inter-modal transfer: 0.98

The results are in close agreement with the work of Uznadze (1958, 1961) who found that set characteristics in the adult are very stable.

Analysis and Results

To test the hypotheses, 58 female first year nursing students were tested for the set characteristics. The sample included 16 hysterics, 16 dysthymics, 7 neurotics, 7 stable, 6 introverts and 6 extraverts. The 58 subjects were chosen from a total of 122 nurses on the basis of extreme scores obtained on the E.P.I. The hysterics and dysthymics were given similar set tasks; the neurotics and the stable were given similar set tasks, as were the introverts and extraverts.

The statistical computations on the data used are found in Appendix E, pp. 154-162. Each table contains the frequencies, the calculation of D values and the significance at the .01 level for the two groups used to test a given hypothesis. However, hypotheses 4 and 6, as well as the extinction of set in the visual modality in the neurotic and stable group and the extinction of set in the visual modality in the

introvert and extravert group were not subject to a statistical test. Because there was no fixation of set, there was no set present to be extinguished. On logical grounds statistical analysis was not necessary.

The data corresponding to hypotheses 1-6 is found in Table III, p. 103, the data corresponding to hypothesis 7 in Table IV, p. 104 and the data corresponding to hypothesis 8 in Table V, p. 105. Each table contains the number of subjects, the D value and the critical D value for each of the set characteristics. The level of significance chosen for this research is $p \leq .01$. Set characteristics that are statistically significant are marked with an asterisk (*).

TABLE III

PERFORMANCE OF HYSTERIC(S)(H) AND DYSTHYMICS (D) ON
SET EXCITATION, EXTINCTION AND IRRADIATION

Modality Involved	Excitation or Extinction		Trials							D	d) Critical D
			0 a)	1-2 b)	3-5	6-10	11-15	16-19	c) 20+		
Haptic	Excitation	H	-	14	1	0	1	0	0	9	9*
		D	-	5	10	0	0	1	0		
Haptic	Extinction	H	-	2	6	2	1	5	0	4	9
		D	-	6	5	2	1	1	1		
Visual	Excitation	H	-	0	9	2	0	0	5	11	9*
		D	-	0	0	0	1	0	15		
Visual	Extinction	H	5	2	4	0	0	5	0		e)
		D	15	1	0	0	0	0	0		
Haptic to visual	Excitation of Irradiated set	H	-	3	6	2	0	0	5	11	9*
		D	-	0	0	0	0	0	16		
Visual	Extinction of Irradiated set	H	5	4	0	1	2	4	0		e)
		D	16	0	0	0	0	0	0		

NOTES:

- The '0' category refers to subjects who do not fixate a set in 25 setting trials in the visual modality and thus do not have a set present to extinguish.
- Figure refers to the number of subjects who fixate a set in '1-2' trials.
- Individuals who require an infinite number of trials to excite or extinguish a set.
- From Kolmogorov-Smirnov, Table L (Siegel, 1956).
- No statistical analysis is possible for set extinction differences in the visual modality since dysthymic subjects do not fixate a set in 25 trials and thus have no set present to extinguish.

TABLE IV

PERFORMANCE OF NEUROTICS (N) AND STABLE (S) ON SET
EXCITATION, EXTINCTION AND IRRADIATION

Modality Involved	Excitation or Extinction		Trials							D	d) Critical D
			a) 0	1-2	3-5	6-10	11-15	16-19	c) 20+		
Haptic	Excitation	N	-	7 ^{b)}	0	0	0	0	0	1	6
		S	-	6	1	0	0	0	0		
Haptic	Extinction	N	-	0	2	0	0	5	0	1	6
		S	-	1	1	0	0	5	0		
Visual	Excitation	N	-	0	0	1	1	0	5	1	6
		S	-	1	0	0	1	0	5		
Visual	Extinction	N	5	0	0	0	0	2	0		e)
		S	5	0	0	0	0	2	0		
Haptic to Visual	Excitation of Irradiated set	N	0	0	0	0	0	0	7	0	6
		S	0	0	0	0	0	0	7		

NOTES:

- The '0' category refers to subjects who do not fixate a set in 25 setting trials in the visual modality and thus do not have a set present to extinguish.
- Figure refers to the number of subjects who fixate a set in '1-2' trials.
- Individuals who require an infinite number of trials to excite or extinguish a set.
- From Kolmogorov-Smirnov, Table L (Siegel, 1956).
- No statistical analysis is possible for set extinction differences since 5 subjects in each group do not fixate a set in 25 trials and thus have no set present to extinguish.

TABLE V
PERFORMANCE OF EXTRAVERTS (E) AND INTROVERTS (I)
ON SET EXCITATION AND EXTINCTION

Modality Involved	Excitation or Extinction		Trials							D	d) Critical D
			a)						c)		
			0	1-2	3-5	6-10	11-15	16-19	20+		
Haptic	Excitation	E	-	b) 6	0	0	0	0	0	1	6
		I	-	5	1	0	0	0	0		
Haptic	Extinction	E	-	1	5	0	0	0	0	4	6
		I	-	5	1	0	0	0	0		
Visual	Excitation	E	-	1	0	0	0	0	5	1	6
		I	-	0	0	0	0	0	6		
Visual	Extinction	E	4	2	0	0	0	0	0		e)
		I	6	0	0	0	0	0	0		

NOTES:

- a. The '0' category refers to subjects who do not fixate a set in 25 setting trials in the visual modality and thus do not have a set present to extinguish.
- b. Figure refers to the number of subjects who fixate a set in '1-2' trials.
- c. Individuals who require an infinite number of trials for set excitation or extinction.
- d. From Kolmogorov-Smirnov, Table L (Siegel, 1956).
- e. No statistical analysis is possible for set extinction differences since 4 extraverts and 6 introverts do not fixate a set in 25 trials and thus have no set present to extinguish.

Results Related to the Major Hypotheses

In the following pages the results are presented in the same chronological order as the hypotheses on pp.90-91. The major hypotheses are stated briefly with their statistical results, with the exception of hypotheses 4 and 6 where statistical results were not logically useful.

H:1 Hysterics in comparison with dysthymics fixate a set in the haptic modality in fewer trials.

The result is reported in Table III, p.103 in the row entitled 'Haptic Excitation.' This difference was significant ($p \leq .01$). These results supported this hypothesis. Fourteen hysterics fixated a set in 1 or 2 trials in the haptic modality, while only 5 dysthymics fixated a set within the same number of trials.

H:2 Hysterics in comparison with dysthymics require a larger number of trials to extinguish a set in the haptic modality.

The result is reported in Table III in the row 'Haptic Extinction.' This difference was not significant ($p \leq .01$). These results do not support this hypothesis. However, from an observation of the results, hysterics tended to require a larger number of trials to extinguish the set.

H:3 Hysterics in comparison with dysthymics fixate a set in the visual modality in fewer trials.

The results are reported in Table III in the row 'Visual Excitation.' This difference was significant ($p \leq .01$). These results supported this hypothesis. Eleven hysterics fixated a set in 10 trials or less. Fifteen dysthymics failed to fixate a set in the visual modality in 25 trials.

H:4 Hysterics in comparison with dysthymics require a larger number of trials to extinguish a set in the visual modality.

This result is reported in Table III in the row 'Visual Extinction.' Because 15 of the 16 dysthymics did not fixate a set in the visual modality and the 16th subject extinguished a set on the first trial, the group could not be tested for set extinction. Hence, on logical grounds no statistical analysis was necessary to test this hypothesis.

H:5 Hysterics in comparison with dysthymics require a fewer number of trials to irradiate a set from the haptic to the visual modality.

This result is reported in Table III in the row 'Haptic to Visual, Excitation of Irradiated Set.' The difference was significant ($p \leq .01$). These results supported this hypothesis. Eleven hysterics irradiated a set; dysthymics did not irradiate a set in 25 trials.

H:6 Hysterics in comparison with dysthymics require a larger number of trials to extinguish an irradiated set in the visual modality.

This result is reported in Table III in the row 'Visual, Extinction of Irradiated Set.' Because the 16 dysthymics did not fixate an irradiated set from the haptic to the visual modality, the group could not be tested for set extinction. Hence, on logical grounds no statistical analysis was possible to test this hypothesis.

Results Related to the Minor Hypotheses

H:7 Neurotics, compared to the stable, will require a larger number of trials for set fixation and extinction in the haptic and visual modalities and to irradiate a set from the haptic to the visual modality.

These results are reported in Table IV, p.104. The differences between the neurotic and the stable groups on all the set tasks were not significant ($p \leq .01$). These results did not support this hypothesis. Neurotics and the stable excite quickly in the haptic modality and extinguish the set slowly. Five neurotics and 5 stable subjects did not fixate a set in the visual modality and thus there was no set present to extinguish. Neither the neurotics nor the stable subjects were able to irradiate a set from the haptic to the visual modalities.















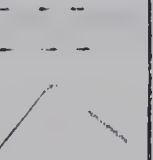
H:8 Extraverts compared to introverts will require a larger number of trials for set fixation and extinction in both the haptic and visual modalities.

These results are reported in Table V, p.105. The differences between the extraverts and introverts on all set tasks were not significant ($p \leq .01$). These results did not support this hypothesis. Both the introverts and the extraverts fixated a set in the haptic modality within few trials, but they also extinguished the set quickly. Since 4 extraverts and 6 introverts did not fixate a set in the visual modality, there was no set present to extinguish.

In summary, on the basis of results related to the hypotheses, (found in Table VI, p.109), it may be stated that:

1. Hysterics in comparison with dysthymics required fewer trials for set excitation in the haptic modality.
2. Hysterics and dysthymics did not differ in the number of trials required for set extinction in the haptic modality.
3. Hysterics in comparison with dysthymics required fewer trials for set excitation in the visual modality.
4. Hysterics and dysthymics could not be compared with regard to the number of trials required for set extinction in the visual modality since dysthymics did not fixate a set and thus had no set present to extinguish.
5. Hysterics compared with dysthymics required a fewer number of trials to irradiate a set from the haptic to the visual modality.

TABLE VI
SUMMARY OF RESULTS OBTAINED
FROM HYPOTHESES

GROUPS	MODALITY					
	HAPTIC		VISUAL		HAPTIC-VISUAL	
	Excitation	Extinction	Excitation	Extinction	Irradiation	Extinction
Hysteries vs. Dythymics						
Neurotics vs. Stable						
Extraverts vs. Introverts						

Solid : Hypothesis
 Dotted : Data
 < : Less
 > : More
 == : Nonsignificant
 || : Nontestable

6. Hysterics and dysthymics could not be compared with regard to the number of trials required for the extinction of the irradiated set, since the dysthymics did not irradiate a set and hence did not have a set present to extinguish.
7. There was no difference between neurotics and stable subjects with regard to the number of trials required for set excitation and extinction in the haptic modality, set excitation and extinction in the visual modality and for the irradiation of set from the haptic to the visual modality.
8. There was no difference between introverts and extraverts with regard to the number of trials required for set excitation and extinction in the haptic modality, or any difference between set excitation and extinction in the visual modality.

Discussion

1. Modalities:

One prominent feature observed from the experimental results is the set excitation involving the haptic and the visual modalities. The number of trials required for set excitation in the haptic modality for all the subjects is relatively small; all 58 subjects fixate a set in few setting trials. Probably the emphasis on manipulation as the initial basis for the emergence of set (Uznadze, 1958) reinforces the idea of the importance of grasping in the evolution of the species (Bruner, 1966; Vygotsky, 1962) and in the evolution of the individual (Vygotsky, 1962). The importance of the manipulatory behavior in ontogenesis is also a fundamental postulate in Piagetian theory (Piaget, 1950).

Excitation of set in the visual modality is slower than excitation in the haptic modality. Forty-one of the 58 subjects are unable to fixate a set in 25 setting trials. Probably the visual modality is not as highly developed in ontogenesis, since the visual modality involves less active participation with the environment as compared with motor manipulation. For this reason, the haptic modality is still useful in set formation and thus in the education process. However, the education

process does involve the visual modality to a great extent.

The irradiation of set clearly corresponds to one's ability to fixate a set in the modality involved. For example, subjects who experience difficulty in fixating a set in the visual modality also have difficulty in transferring a set from the haptic to the visual modality.

Organisms also rely on the auditory modality for participation with the environment. Techniques for testing set characteristics involving one's hearing and their results could prove very interesting since much of our education involves the use of the auditory modality.

2. Groups:

The majority of the hysterics used in this experiment are able to fixate a set in the haptic and visual modalities. Generally, fixation occurs relatively more quickly than does the extinction process. Because 11 of the 16 subjects are able to fixate a set in the visual modality, they are also able to irradiate a set from the haptic to the visual modality. Because of these set characteristics, the hysteric would probably possess a strong nervous system (Pavlov, 1927; Teplov, 1962), correspond to the impulsive individual (Norakidze, 1958) and represent the choleric temperament. The subject would be more suggestible, easier to teach and probably excel in visual-motor manipulations such as sports.

The dysthymics are able to fixate a set in the haptic modality, and 15 of the 16 subjects are able to extinguish the set. However, 15 of the 16 subjects are unable to fixate a set in the visual modality in 25 setting trials and unable to irradiate a set from the haptic to the visual modality. Because of these set characteristics, the dysthymic would probably possess a weak nervous system (Pavlov, 1927; Teplov, 1962), correspond to the conflictive individual (Norakidze, 1958) and

represent the melancholic temperament. The subject would probably be more difficult to teach, more rigid and require more attention in the education process.

The neurotics and the stable do not perform differently on Uznadze set tasks, and neither do the introverts and the extraverts. However, the extravert described by Uznadze (1958) does not perform on the set tasks in the same manner as does the extravert in Eysenckian theory, since the extraverts in this experiment are able to fixate a set, especially in the haptic modality.

Several reasons may be postulated for no differences in the groups. Since Norakidze (1966) speaks of the conflictive, the harmonious and the impulsive groups, and Eysenck (1957) speaks of the hysterics, dysthymics, introverts, extraverts, stable and neurotics, it appears that if individuals as described by Eysenck do in fact exist, they would be subsumed in the typology used by Norakidze. It would probably be advantageous for Norakidze to have specific sub-groups differentiated by more extensive set characteristics. For example, the conflictive group could possibly have several sub-groups, as could the harmonious and impulsive groups. If this was done, then comparisons with the types described by Eysenck could probably be made more clearly.

Although the subjects do not differentiate on the set tasks used in this investigation, further experimental investigation in the area may reveal some group differences. For example, auditory set tasks, or setting to quality (words and pictures), or even in the types of illusions exhibited by the subjects may differentiate the groups. Only further research in the area can provide some of the answers.

CHAPTER V

SUMMARY, CONCLUSIONS AND IMPLICATIONS

I. SUMMARY

A study was undertaken to describe Uznadze's theory of set and personality, present several Western views on set and to investigate the phenomenon of set empirically. In comparing Western and Soviet psychological theory, invariably certain difficulties are encountered. Some of these include the availability of materials and the proper translation and interpretation of psychological terms.

Set does not have a similar meaning for psychologists (Gibson, 1941). Many of the Western views on set are not synonymous with those of Georgian psychologists. Western psychologists (Freeman, 1955; Luchins, 1942; Mowrer, 1940; Woodworth, 1954) stress the importance of set, but do not consider it basic to all activity. Probably a drawback in Western theorizing results from the lack of any one person devoting his full time to the study and research of set. Uznadze, on the other hand, devoted the majority of his studies to the investigation of set; his theory of set was the result of many years of experimental investigation and inductive reasoning.

Set, as a term underlying human activity, does not pretend to explain every facet of human behavior. However, Uznadze (1961) states that activity has a definite relationship to set. For Uznadze, set is the mobilization or a readiness of the individual for activity in a certain direction. One is usually not aware of sets operating at

any time; it is this activity which Uznadze calls the unconscious.

Set arises in the presence of a basic perception, a need and a situation to satisfy the need. Uznadze points out that needs may be substantive (organic), functional (need for activity), or intellectual.

Set, as Uznadze defines it, provides one with a new model of behavior. One acts in a certain manner due to the influence of fixed sets operating at the time. It is possible to change one's behavior but this implies the use of will. Man is not a machine or a robot who has no control over his behavior, but the amount of control that one has depends upon his ability to perceive objectively (objectivate) situations. Uznadze emphasizes that man is a superior animal who has the ability to see the world as it is and to note that he is part of it. On a practical level, this means that when the smooth course of activity is in some way disrupted, a man cognitively reassembles the circumstances to develop a new set which redirects his activity.

It would be wrong to conclude that Western concepts of set are radically different from the Georgian formulations. However, Uznadze would disagree with Western ideas that set is secondary rather than being basic to behavior, or that set is another variable that influences behavior. Some of the following formulations of Allport (1955) are similar to those of Uznadze: that set has importance in behavior, that sets may be unconscious, that one may "store" sets and that people may be instructed or helped to form and change their sets.

Although Helson's adaptation level has been compared with set, the two theories differ in more aspects than they are similar. Helson (1964), from a psychophysical point of view, emphasizes the importance of stimuli and the prediction of responses on the basis of complex

formulations. Helson, as other Western psychologists (Woodworth, 1947; Young, 1925), views set as a factor which may influence behavior; in fact, there is meagre reference to the term in his writing. For Uznadze, sets are psychophysiological mechanisms which determine behavior. The approach emphasizes the whole individual, his needs and situations for their satisfaction.

For Uznadze (1958, 1961, 1966) the phenomenon of set as the basis for all activity is applicable in identifying individuals with common personality characteristics. Uznadze grouped people into three categories according to set characteristics: the dynamic group, the static group, and the variable group.

Norakidze (1958, 1966), with an elaboration of the work of Uznadze, studies set characteristics of individuals possessing common phenotypic personality characteristics (impulsive, harmonious and conflictive) and set properties of different temperament types.

Through factor analysis Eysenck has devised the Eysenck Personality Inventory, which differentiates individuals along a neuroticism dimension and an extraversion-introversion dimension. In addition, the neurotic introverts form the dysthymic group while the neurotic extraverts form the hysteric group. The factors isolate certain properties of the nervous system (Eysenck, 1955, 1957), based on the work of Pavlov (1927).

According to Eysenck (1955), hysterics and dysthymics perform differently on tasks producing kinesthetic after-effects. The differences are explained in terms of different amounts of excitation and inhibition produced in strong or weak nervous systems (Pavlov, 1927).

The empirical problem in this research was to differentiate individuals by means of the Eysenck Personality Inventory (subjects with

extreme scores on the introversion, extraversion, neuroticism and the stable dimensions , as well as the hysteric and the dysthymic groups, and observe their performance on Uznadze set tasks. The hysteric and the dysthymic subjects were observed for the number of trials required to (1) excite and extinguish a set in the haptic modality; (2) excite and extinguish a set in the visual modality; (3) irradiate a set from the haptic to the visual modality and; (4) extinguish the irradiated set. The stable and the neurotic were observed for the number of trials required to (1) excite and extinguish a set in the haptic modality; (2) excite and extinguish a set in the visual modality; (3) irradiate a set from the haptic to the visual modality. The introverts and extraverts were observed for the number of trials required to (1) excite and extinguish a set in the haptic modality; (2) excite and extinguish a set in the visual modality.

The experimental procedure was also an investigation of terms used by Norakidze and Eysenck. If the terms are synonymous, then it follows that performance on set tasks by subjects differentiated by the Eysenck Personality Inventory should excite, extinguish and irradiate a set similarly to subjects used by Uznadze (1958, 1961) and Norakidze (1958). Briefly, the hypotheses tested are as follows (Chapter IV):

1. Hysterics compared with dysthymics:
 - a. fixate a set with fewer trials in the haptic and visual modalities;
 - b. require a larger number of trials to extinguish a set in the haptic and visual modalities;
 - c. irradiate a set from the haptic to the visual modality in fewer trials;
 - d. require a larger number of trials to extinguish the irradiated set in the visual modality.
2. Neurotics compared with stable subjects will require a larger number of trials for set excitation and extinction in the haptic and visual modalities and for irradiation from the haptic to the visual modality.

3. Extraverts compared with introverts will require a larger number of trials for set excitation and extinction in the haptic and visual modalities.

The results of the experimental investigation are as follows:

1. Hysterics in comparison with dysthymics require fewer trials for set excitation in the haptic modality.
2. Hysterics and dysthymics do not differ in the number of trials required for set extinction in the haptic modality.
3. Hysterics in comparison with dysthymics require fewer trials for set excitation in the visual modality.
4. Hysterics and dysthymics cannot be compared statistically with regard to the number of trials required for set extinction in the visual modality since dysthymics do not fixate a set and thus have no set present to extinguish.
5. Hysterics compared with dysthymics require a smaller number of trials to irradiate a set from the haptic to the visual modality.
6. Hysterics and dysthymics cannot be compared statistically with regard to the number of trials required for the extinction of the irradiated set since the dysthymics do not irradiate a set and hence do not have a set present to extinguish.
7. There is no difference between neurotics and stable subjects with regard to the number of trials required for set excitation and extinction in the visual modality and for the irradiation of set from the haptic to the visual modality.
8. There is no difference between introverts and extraverts with regard to the number of trials required for set excitation and extinction in the haptic modality, nor any difference between set excitation and extinction in the visual modality.

II. CONCLUSIONS

A. An important difference between Uznadze's and Western views on set is that Uznadze considers set to be basic to all human activity. For Western psychologists set is an auxiliary term; it is not thought

to be basic to all human activity.

B. Uznadze emphasizes the central nature of set since irradiation proves that set is a function of the central nervous system. Western psychologists such as Luchins think of set as being central (cortical) in nature; while others such as Freeman, think set is a peripheral (non-cortical) phenomenon.

C. The concept of adaptation level held by Helson, with emphasis on averaging or pooling classes of stimuli, is not synonymous with Uznadze's concept of set. However, both adaptation level (Helson, 1964) and set (Uznadze, 1961) are associated with human activity such as perception and thought.

D. The Einstellung Effect described by Luchins is similar to that of Uznadze because both consider the central (cortical) nature of set. However, Luchins considers Einstellung important in the area of problem solving, which is only a small part of one's activity. Set for Luchins is not a factor in all activity.

E. From the experimental results, the different performances by hysterics and dysthymics on set tasks confirm some of the findings of Eysenck (1955). In addition (1) the choleric and melancholic temperaments are similar in both Eysenck's and Norakidze's theorizing; (2) the hysterics and the impulsive individuals possess several similar set characteristics, such as ease of excitation; (3) the dysthymics and the conflictive individuals have a similar set characteristic, namely the difficulty for many to fixate a set in the visual modality; (4) the term 'extravert' does not appear to have similar meanings in both Eysenck's and Uznadze's theory. Uznadze (1961) describes an extravert as one unable to fixate a set in a small number of trials in

a specific situation. Extraverts differentiated on the basis of the E.P.I. were able to fixate a set, especially in the haptic modality. This suggests that the equivalent meaning of concepts should be carefully studied before they are adapted for theorizing; (5) hysterics are able to fixate and extinguish a set in both the haptic and visual modalities, and to irradiate a set from the haptic to the visual modality. Dysthymics fixate and extinguish a set in the haptic modality but they do not readily fixate a set in the visual modality, nor do they irradiate a set from the haptic to the visual modality; (6) neurotics and stable do not differ in the performance of Uznadze set tasks; (7) extraverts and introverts do not differ in set task performance.

III. THEORETICAL IMPLICATIONS

A. In Western psychology (Forgus, 1966) the importance of set continues to be stressed, especially in the education process. Any instruction, stated or assumed, establishes behavioral sets and defines the task or goal for the subject. However, set is not only induced by instruction but also by some aspects of the stimulus, as for example, the relative frequency with which a stimulus appeared in prior training. In addition, set influences thinking and concept formation. A set group shows superior comprehension, faster learning and better retention of concepts. Moreover, set may facilitate or impede problem-solving behavior.

B. Uznadze's work on set attempts at answering not only the importance of set for psychological theory but also the nature of set itself.

Response is mediated by an intermediate organization of experience

which is not restricted to the narrow compass of some discrete human sense modality, but extends to all sensory modalities. Thus, the concept of "motor" and "mental" sets described by Western psychologists is in contraposition to the Georgian view. The set as a pre-orientedness or a disposition to respond in a definite way stands out as the general organismic factor of the inner organization of the individual lying between the stimulus and the response.

In contradistinction to theories which interpret set as an exclusively subjective factor of behavior, set is a specific state of response adequacy to the given conditions of activity. Thus set must be conceived as the whole state of the individual at each discrete moment of his activity, which represents the highest organizational level of man's "essential powers" of the mind, and brings into focus all those inner dynamic relations that mediate in the individual the psychological effect of stimuli acting on him (Prangishvili, 1966, 53). It provides the basis for the emergence of definitely oriented activity as a process of bringing in balance the relationships between the individual and his environment.

Prangishvili adds:

Thus set belongs in the mental domain, for its function (as an intervening variable and evincing as it does the psychological content of the inter-relationship between need and situation), two determinants of mental activity, is: (1) to give expression to the "purposeful meaning" of the situation and (2) to determine the direction of activity and of the process of consciousness (Prangishvili, 1966, 56).

G. From the empirical point of view, Teplov (1966) notes that Pavlovian theory of personality posits three dimensions along which nervous activity (and hence behavior) is conceived to vary: strength

of nervous activity, mobility, and equilibrium between the processes of excitation and inhibition. Thus, with regard to temperament, Pavlov (1927) predicted the melancholic to be inhibitory in nature, with the choleric possessing a moderate predominance of excitatory process.

Mobility, one of the basic and elementary processes of the nervous system, refers to the changes in acquired behavior or perceptual patterns, and the speed with which nervous processes arise and come to an end. Physiologically, mobility reflects differences between analyzers or regions in the cortex (Gray, 1964). The duration of after-effects of excitation is usually regarded as an index of mobility (Teplov, 1962). The individual set characteristics may reflect mobility. Dysthymics who do not readily fixate in the visual modality and do not irradiate a set, possess a nervous system with low mobility. The hysteric fixates a set in the haptic and visual modalities as well as irradiates a set from the haptic to the visual modality; extinction of set proceeds slowly. Hysterics are characterized by nervous systems with high mobility.

For Pavlov (1927) the weakness of the nervous system is characterized by high reactivity or sensitivity. The dysthymics possess a weak nervous system since the individual is able to accurately perceive set objects (circles) in the visual modality. Hysterics possess a strong nervous system since they do not accurately perceive each critical or set test. Thus it follows that a strong nervous system has high mobility (Gray, 1964).

The neurotics and stable as well as the introverts and extraverts possess weak nervous systems with low mobility. To conclude that introverts and extraverts or neurotics and stable possess similar set characteristics and hence similar nervous system properties would not be accurate.

Differentiation may be found in conducting set tests in other modalities (auditory, kinesthetic), examining the phases of set extinction or the number and types of illusions. Since Norakidze (1966) describes the harmonious, conflictive and impulsive types, and Eysenck (1947, 1957) describes introverts, extraverts, neurotics, stable, hysterics and dysthymics, it is impossible to obtain a direct relationship among the types. However, subgroups of Norakidze's types may correspond more closely to Eysenck's types.

Regardless of the personality type, set fixation occurs with ease in the haptic modality. The nervous processes have greater strength in the haptic analyzers than the processes in the visual analyzers (Gray, 1964), which may result in greater consolidation of the dynamic stereotypes (Norakidze, 1962). In early stages of human development the sense of touch (both phylogenetically and ontogenetically) is used extensively as a means of relating with the environment resulting in the frequent use of haptic analyzers. The consolidation and strength of the analyzers relates to manipulation as the initial basis for the emergence of set.

IV. SET AND EDUCATION

Uznadze (1958, 1961) notes that the process of education is the proper formation of sets. If children have a rigid or static, plastic or dynamic sets, excite or extinguish with difficulty, the behavior will reflect their set characteristics. A teacher must be aware that certain students require more attention and help to objectivate (perceive objectively) situations and to change from the first (impulsive) to the second (rational) plane of behavior. A teacher can verbally provide needs and situations for a pupil's set formation.

One may examine certain aspects of education that are directly related to the phenomena of set.

1. For Prangishvili (1958), memory is the product of an individual's activity emerging on the second plane of behavior. Therefore, students who act on the first plane must be taught to objectivate during the learning process.

2. The effect of set upon the directionality of thinking in the process of problem solving has been investigated by Eliava (1966). It is set that brings thinking into contact with a given problem. Pupils who do not persist with a task may simply not possess a set corresponding to that task. The teacher must be aware of the specific mental acts which manifest themselves in the subject's cognitive orientation towards what is presented to them.

3. Natadze's (1960) work on imagination and set formation may explain a student's behavior toward subjects, instruction and teachers. The greater the capacity for imagination the greater the ease for set formation.

4. Troschenok (1961) draws attention to the importance of set in physical education. An instructor must be aware of a player's set irradiation characteristics in the haptic and visual modalities. The ability to start and sustain a sport activity is basic to set.

5. The manner in which one makes errors in oral speech may be examined by the teacher from the point of view of set. With a need for communication and an appropriate speech situation, forms of words emerge corresponding to an idea. Errors, such as fusion or substitution which are momentary and unconscious, may occur. These errors may be attributed to set (Mchedlishvili, 1966).

V. FURTHER RESEARCH

Since the theory of set opens a new field of research in North America, there are many possibilities for further research. A few of the possibilities include:

1. The relationship between set and other organic variables, e.g. G.S.R., E.E.G., etc.
2. The relationships of set characteristics to other personality measures, e.g. M.M.P.I.
3. Construction of paper and pencil set tests on the basis of set behavior of subjects.
4. The comparison of set characteristics with social-status, attitudes and intelligence.
5. The study of achievement as related to set characteristics.

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APPENDIX A

GLOSSARY

NOTE:

This glossary is, as the term might imply, a set of glosses (explanations or comments) on certain words in the thesis. This is not a dictionary. What follows is meant to be a ready and informal guide for the reader. For explanations and examples with regard to the experimental procedure, only the haptic modality will be used.

Assimilative illusion. Occur during critical trials, when for example a subject is momentarily presented with equal spheres, the object is perceived larger in the hand which during set trials experienced the larger sphere (Uznadze, 1961).

Character. Denotes a person's more or less stable and enduring system of conative behavior (Eysenck, 1960). The central significant sphere of the personality concerned with man as a social being (Norakidze, 1966).

Contrast illusion. Occur during critical trials, when for example a subject is momentarily presented with equal spheres, the object is perceived larger in the hand which during set trials experienced the smaller sphere (Uznadze, 1961).

Diffused set. Found in the initial stages of set formation, when produced for the first time, set is in a comparatively undifferentiated and unindividualized state (Uznadze, 1958).

Constancy of set. The manifestation of the same type of set in an individual through the passage of time (Uznadze, 1961).

Critical trials. The experimental procedure used to test for set fixation which follows the set trials. For example, several presentations of two unequal spheres are followed by the presentation of two equal spheres; if the individual perceives the two equal spheres as unequal, then one assumes that set fixation had occurred (Uznadze, 1961).

Dynamic set. A set which passes through the various phases of extinction, namely from contrast illusion to assimilative illusions followed by veridical perception (Uznadze, 1961).

Fixed set. The differentiated state of set achieved by repeated presentations of appropriate stimuli (Uznadze, 1961).

Higher nervous activity. The activity of the cortex and higher parts of the sub-cortex which maintains the complex relations of the whole organism to the external world (Pavlov, 1927).

Illusion. A conflict which arises between the actual set of the subject and the stimuli acting upon him, for example, a subject who has a set to perceive two unequal spheres, may perceive two equal spheres as unequal (Uznadze, 1961).

Lability of set. A set property indicating the rapid fading of a fixed set in time (Uznadze, 1961).

Personality. The subject of activity of which set is the dynamic structural unit (Uznadze, 1961). The integrated organization of all the cognitive, affective, conative, and physical characteristics of an individual as it manifests itself in focal distinctness to others (Eysenck, 1947).

Plane of impulsive behavior. The level at which individual behavior is stimulus bound, where an organism responds directly to the given situation at any particular moment on the basis of his fixed set (Uznadze, 1961).

Plane of objectivization. The level of activity associated with intellectual behavior; the introduction of a complication into a given act whereby the smooth course of activity is interrupted and a special act occurs such that the object or phenomenon is turned into an independent object of observation or act of attention (Uznadze, 1958).

Plasticity of set. Set which manifests itself in a gradual smooth transition from one phase to another (Uznadze, 1961).

Rigid set. In set extinction, the intermediate phase of assimilative illusions is not present and set passes from contrast illusions to veridical perception (Uznadze, 1961).

Set extinction. The gradual weakening of a set; experimentally, after repeated presentations of equal spheres, a subject begins to perceive them as equal rather than unequal (Uznadze, 1961).

Set fixation. The development of a state of readiness to act in a certain direction in the presence of a need and a situation to satisfy the need (Uznadze, 1961).

Set irradiation. The transposition or transfer of set from one organ to another as well as from one sense modality to another. Experimentally, the repeated presentation of two unequal spheres in the haptic modality will result in a set which transfers to the visual modality; the subject perceives two equal circles as unequal (Uznadze, 1961).

Set phases. The extinction of set passing through stages of contrast illusions to assimilative illusions and finally to veridical perception (Uznadze, 1961).

Set test. The process of set fixation; experimentally, the momentary presentation to a subject of two unequal spheres. The repetition of the presentation fixates a set in the subject which enables him to perceive the spheres unequally (Uznadze, 1958).

Stability of set. A property which indicates the degree of preservation of a fixed set in time (Uznadze, 1961).

Static set. A set in individuals which does not pass through all the phases of extinction and veridical perception of objects is not reached (Uznadze, 1961).

Temperament. The characteristic phenomenon of an individual's emotional nature, including his susceptibility to emotional stimulation, his customary strength and speed of response and the quality of his prevailing mood (Eysenck, 1947; Norakidze, 1966).

Trait. The observed constellation of an individual's action tendencies (Eysenck, 1947); stable forms of attitudes (Norakidze, 1966).

Type. An observed constellation of syndromes of traits (Eysenck, 1947); a group of individuals classified according to individual differences in relation to properties of set such as excitability, extinction and irradiation (Norakidze, 1966).

Variability of set. A property of set whereby an individual manifests different types of set through time (Uznadze, 1961).

Will. The strength an individual possesses that enables him to change consciously from one set to another (Uznadze, 1961).

APPENDIX A

	2010	2011
1. Total population	1,000,000	1,000,000
2. Total population aged 15 and over	750,000	750,000
3. Total population aged 15 and over, by sex		
Male	375,000	375,000
Female	375,000	375,000
4. Total population aged 15 and over, by education level		
Less than primary	100,000	100,000
Primary	400,000	400,000
Lower secondary	150,000	150,000
Upper secondary	100,000	100,000
Tertiary	50,000	50,000
5. Total population aged 15 and over, by employment status		
Employed	500,000	500,000
Unemployed	250,000	250,000
Retired	100,000	100,000
Other	50,000	50,000

APPENDIX B

1. Total population	1,000,000	1,000,000
2. Total population aged 15 and over	750,000	750,000
3. Total population aged 15 and over, by sex		
Male	375,000	375,000
Female	375,000	375,000
4. Total population aged 15 and over, by education level		
Less than primary	100,000	100,000
Primary	400,000	400,000
Lower secondary	150,000	150,000
Upper secondary	100,000	100,000
Tertiary	50,000	50,000
5. Total population aged 15 and over, by employment status		
Employed	500,000	500,000
Unemployed	250,000	250,000
Retired	100,000	100,000
Other	50,000	50,000
6. Total population aged 15 and over, by income level		
Low	100,000	100,000
Medium	400,000	400,000
High	250,000	250,000
7. Total population aged 15 and over, by health status		
Good	500,000	500,000
Fair	250,000	250,000
Poor	100,000	100,000
8. Total population aged 15 and over, by housing status		
Owned	500,000	500,000
Rented	250,000	250,000
Other	100,000	100,000

*

EYSENCK PERSONALITY INVENTORY

	<u>Yes</u>	<u>No</u>
1. Do you often long for excitement?	_____	_____
2. Do you often need understanding friends to cheer you up?	_____	_____
3. Are you usually carefree?	_____	_____
4. Do you find it very hard to take no for an answer?	_____	_____
5. Do you stop and think things over before doing anything?	_____	_____
6. If you say you will do something do you always keep your promise, no matter how inconvenient it might be to do so?	_____	_____
7. Does your mood often go up and down?	_____	_____
8. Do you generally do and say things quickly without stopping to think?	_____	_____
9. Do you ever feel "just miserable" for no good reason?	_____	_____
10. Would you do almost anything for a dare?	_____	_____
11. Do you suddenly feel shy when you want to talk to an attractive stranger?	_____	_____
12. Once in a while do you lose your temper and get angry?	_____	_____
13. Do you often do things on the spur of the moment?	_____	_____
14. Do you often worry about things you should not have done or said?	_____	_____
15. Generally, do you prefer reading to meeting people?	_____	_____
16. Are your feelings rather easily hurt?	_____	_____
17. Do you like going out a lot?	_____	_____
18. Do you occasionally have thoughts and ideas that you would not like other people to know about?	_____	_____

*

Eysenck, H.J. Eysenck Personality Inventory. London: University of London Press, 1964.

	<u>Yes</u>	<u>No</u>
19. Are you sometimes bubbling over with energy and sometimes very sluggish?	_____	_____
20. Do you prefer to have few but special friends?	_____	_____
21. Do you daydream a lot?	_____	_____
22. When people shout at you, do you shout back?	_____	_____
23. Are you often troubled about feelings of guilt?	_____	_____
24. Are all your habits good and desirable ones?	_____	_____
25. Can you usually let yourself go and enjoy yourself a lot at a gay party?	_____	_____
26. Would you call yourself tense or "highly-strung"?	_____	_____
27. Do other people think of you as being very lively?	_____	_____
28. After you have done something important, do you often come away feeling you could have done better?	_____	_____
29. Are you mostly quiet when you are with other people?	_____	_____
30. Do you sometimes gossip?	_____	_____
31. Do ideas run through your head so that you cannot sleep?	_____	_____
32. If there is something you want to know about, would you rather look it up in a book than talk to someone about it?	_____	_____
33. Do you get palpitations or thumping in your heart?	_____	_____
34. Do you like the kind of work that you need to pay close attention to?	_____	_____
35. Do you get attacks of shaking or trembling?	_____	_____
36. Would you always declare everything at the Customs even if you knew that you could never be found out?	_____	_____
37. Do you hate being with a crowd who play jokes on one another?	_____	_____
38. Are you an irritable person?	_____	_____
39. Do you like doing things in which you have to act quickly?	_____	_____

	<u>Yes</u>	<u>No</u>
40. Do you worry about awful things that might happen?		
41. Are you slow and unhurried in the way you move?	_____	_____
42. Do you have many nightmares?	_____	_____
43. Have you ever been late for an appointment or work?	_____	_____
44. Do you like talking to people so much that you never miss a chance of talking to a stranger?	_____	_____
45. Are you troubled by aches and pains?	_____	_____
46. Would you be very unhappy if you could not see lots of people most of the time?	_____	_____
47. Would you call yourself a nervous person?	_____	_____
48. Of all the people you know, are there some whom you definitely do not like?	_____	_____
49. Would you say that you were fairly self-confident?	_____	_____
50. Are you easily hurt when people find fault with you or your work?	_____	_____
51. Do you find it hard to really enjoy yourself at a lively party?	_____	_____
52. Are you troubled with feelings of inferiority?	_____	_____
53. Can you easily get some life into a rather dull party?	_____	_____
54. Do you sometimes talk about things you know nothing about?	_____	_____
55. Do you worry about your health?	_____	_____
56. Do you like playing pranks on others?	_____	_____
57. Do you suffer from sleeplessness?	_____	_____

APPENDIX C

SCORING SHEET

Name _____

HAPTIC		VISUAL		IRRADIATION	
Excit.	Extinct.	Excit.	Extinct.	Excit. H.	Extinct. V.
1. L R E	L R E	L R E	L R E	L R E	L R E
2. L R E	L R E	L R E	L R E	L R E	L R E
3. L R E	L R E	L R E	L R E	L R E	L R E
4. L R E	L R E	L R E	L R E	L R E	L R E
5. L R E	L R E	L R E	L R E	L R E	L R E
6. L R E	L R E	L R E	L R E	L R E	L R E
7. L R E	L R E	L R E	L R E	L R E	L R E
8. L R E	L R E	L R E	L R E	L R E	L R E
9. L R E	L R E	L R E	L R E	L R E	L R E
10. L R E	L R E	L R E	L R E	L R E	L R E
11. L R E	L R E	L R E	L R E	L R E	L R E
12. L R E	L R E	L R E	L R E	L R E	L R E
13. L R E	L R E	L R E	L R E	L R E	L R E
14. L R E	L R E	L R E	L R E	L R E	L R E
15. L R E	L R E	L R E	L R E	L R E	L R E
16. L R E	L R E	L R E	L R E	L R E	L R E
17. L R E	L R E	L R E	L R E	L R E	L R E
18. L R E	L R E	L R E	L R E	L R E	L R E
19. L R E	L R E	L R E	L R E	L R E	L R E
20. L R E	L R E	L R E	L R E	L R E	L R E
21. L R E	L R E	L R E	L R E	L R E	L R E
22. L R E	L R E	L R E	L R E	L R E	L R E
23. L R E	L R E	L R E	L R E	L R E	L R E
24. L R E	L R E	L R E	L R E	L R E	L R E
25. L R E	L R E	L R E	L R E	L R E	L R E
26. L R E	L R E	L R E	L R E	L R E	L R E
27. L R E	L R E	L R E	L R E	L R E	L R E
28. L R E	L R E	L R E	L R E	L R E	L R E
29. L R E	L R E	L R E	L R E	L R E	L R E
30. L R E	L R E	L R E	L R E	L R E	L R E
31. L R E	L R E	L R E	L R E	L R E	L R E
32. L R E	L R E	L R E	L R E	L R E	L R E
33. L R E	L R E	L R E	L R E	L R E	L R E
34. L R E	L R E	L R E	L R E	L R E	L R E

PROCEDURE FOR CONDUCTING SET TESTS

A. Fixation of set in the haptic modality

The subject was seated with hands resting on the thighs and palms upward. The subject was blindfolded and the following instructions were then given:

I am going to present two spheres to you, one in each hand. You may grasp them for a moment and then I shall remove them. I shall repeat this a number of times. Each time I do this, please tell me if the spheres feel equal or unequal in size. If you think that they are unequal in size, tell me in which hand you feel the larger one. Please be sure to tell me each time I do this.

Following this, the two spheres of unequal size were placed in the palms, one in each palm with the larger sphere placed in the right palm (setting tests). The subject was allowed to grasp the spheres and then they were removed. The unequal spheres were presented twice and then the test for set was made. This was done by presenting the two equal spheres without informing the subject (critical tests). If they appeared unequal a set had been fixated. If no fixation appeared (that is, they felt equal in size), then the setting trials were resumed. Critical trials subsequently were made after the 5th, 10th, 15th, and 19th setting trial until a set had been fixated or a minimum of 25 setting trials. The verbal response given after each trial was recorded. Part B then followed.

B. Extinction of set in the haptic modality

When the subject perceived the two equal spheres as unequal a set had been established. To extinguish, the critical trials (presentation of the equal spheres) were continued until the spheres were perceived veridically for five consecutive trials or to a maximum of 30 critical trials. The response after each critical trial was recorded. Part C then followed.

C. Fixation of set in the visual modality

The subject was asked to focus her eyes on the tachistoscope. The instructions were:

You will be shown two circles briefly. Each time you see the circles I want you to tell me if the circles appear to be equal or unequal in size. If you think they are unequal, tell me which circle appears larger to you. Please be sure to tell me each time I flash the circles on the screen.

The slides with the circles on them were presented for 0.1 second. The unequal circles were given for two trials, the larger circle on the right, followed by a critical test (equal circles). The subject was not informed of the change. If a set had not been fixated in two trials, the setting trials were continued and the critical tests subsequently were made after the 5th, 10th, 15th, and 19th setting trial until a set had been fixated or to a maximum of 25 setting trials. The response after each trial was recorded. Part D followed.

D. Extinction of set in the visual modality

When the subject perceived the two equal circles as unequal a set had been fixated. To extinguish, the critical trials (presentation of the equal circles) were continued until the circles were perceived veridically for five consecutive trials or a maximum of 30 critical trials. The response after each trial was recorded. Part E followed.

E. Fixation of irradiated set

The subject was asked to look continuously into the tachistoscope and at the same time to place her hands on the table in front of her with the palms upward. The instructions were:

I am going to place the spheres in your palms again, just as I did a few minutes ago when I blindfolded you. I am also going to flash the circles on the screen every so often. However, this time you do not have to tell me what the spheres feel like. I want you to keep looking at the screen and whenever you see

the circles, tell me if they appear equal or unequal in size. If they appear unequal to you, tell me which one seems larger to you. Please be sure to tell me each time I flash the circles.

Two setting trials with the unequal spheres were then given with the larger sphere placed in the right hand. This was followed by the presentation of the two equal circles for 0.1 second by means of the tachistoscope (critical test). If the two circles appeared unequal then the set fixated in the haptic modality had been transferred to the visual modality. If the circles were seen as equal, the setting trials were continued in the haptic modality and critical tests in the visual modality subsequently were made after the 5th, 10th, 15th and 19th setting trials until a set had been transferred or to a maximum of 25 setting trials. The responses were recorded. Part F followed.

F. Extinction of the irradiated set

When the subject perceived the two equal circles as unequal, a set had been transferred to the visual modality. To extinguish, the critical tests (presentation of the equal circles) were continued until the circles were perceived veridically for five consecutive trials, or a maximum of 30 critical trials. The response for each trial was recorded.

APPENDIX E

TABLE I
SET EXCITATION IN THE HAPTIC MODALITY

TYPES	Set Trials					
	1-2	3-5	6-10	11-15	16-20	21+
Hysteries S16 ₁ (X) a)	14/16	15/16	15/16	16/16	16/16	16/16
Dysthymics S16 ₂ (X) b)	5/16	15/16	15/16	15/16	15/16	16/16
Sn ₁ (X) - Sn ₂ (X) c)	9/16	0	0	1/16	1/16	0

1. H_0 : There is no difference between the hysteries and the dysthymics in the number of set trials required for the fixation of a set.
 H_1 : Hysteries require a smaller number of trials for set fixation.
2. Statistical Test: Kolmogorov-Smirnov two-sample test.
3. Significance Level: Let $\alpha = .01$ and $N = 16$.
4. Rejection: A one-tailed test; reject H_0 when observed K_D is ≥ 9 (Siegel, 1956, Table L). Otherwise do not reject H_0 .
5. Decision: The largest discrepancy is 9/16 so $K_D = 9$, which is significant at .01; thus H_0 is rejected in favor of H_1 .

TABLE II
SET EXTINCTION IN THE HAPTIC MODALITY

TYPES	Set Trials					
	1-2	3-5	6-10	11-15	16-20	21+
Hysteries S16 ₁ (X)	2/16	8/16	10/16	11/16	16/16	16/16
Dysthymics S16 ₂ (X)	6/16	11/16	13/16	14/16	15/16	16/16
Sn ₁ (X) - Sn ₂ (X)	4/16	3/16	3/16	3/16	1/16	0

- a) The observed cumulative step function for the 16 hysteries.
- b) The observed cumulative step function for the 16 dysthymics.
- c) The difference between the two observed frequencies.

1. H_0 : There is no difference between hysterics and dysthymics in the number of trials required for the extinction of set.
 H_1 : Hysterics require a larger number of trials for set extinction.
2. Test: Kolmogorov-Smirnov two-sample test.
3. Significance Level: Let $\alpha = .01$ where $N = 16$.
4. Rejection: One-tailed test; reject H_0 when observed K_D is ≥ 9 (Siegel, Table L), otherwise do not reject H_0 .
5. Decision: The largest discrepancy is $4/16$ so that $K_D = 4$, which is not significant at .01 or .05, thus H_0 is not rejected.

TABLE III

SET EXCITATION IN THE VISUAL MODALITY

TYPES	Set Trials					
	1-2	3-5	6-10	11-15	16-20	21+
Hysterics $S16_1(X)$	0/16	9/16	11/16	11/16	11/16	16/16
Dysthymics $S16_2(X)$	0/16	0/16	0/16	1/16	1/16	16/16
$Sn_1(X) - Sn_2(X)$	0	9/16	11/16	10/16	10/16	0

1. H_0 : There is no difference between hysterics and dysthymics with regard to the number of trials needed for the fixation of a set.
 H_1 : Hysterics require a smaller number of trials for set fixation.
2. Test: Kolmogorov-Smirnov two-sample test.
3. Significance level: Let $\alpha = .01$ where $N = 16$.
4. Rejection: One-tailed test; reject H_0 when the observed $K_D \geq 9$ (Siegel, Table L), otherwise do not reject H_0 .
5. Decision: The largest discrepancy is $11/16$ so that $K_D = 11$ which is significant at the .01 and thus H_0 is rejected in favor of H_1 .

TABLE IV
SET EXTINCTION IN THE VISUAL MODALITY

TYPES	Set Trials						
	0	1-2	3-5	6-10	11-15	16-19	20+
Hysterics	5	2	4	0	0	5	0
Dysthymics	15	1	0	0	0	0	0

1. H_0 : There is no difference between hysterics and dysthymics with regard to the number of trials required for the extinction of set.
 H : Hysterics require a larger number of trials for set extinction.

Because 15 of the 16 dysthymics do not fixate a set in the visual modality, and the 16th subject extinguishes a set on the first trial, the group cannot be tested for set extinction. On logical grounds, no statistical analysis is possible to test this hypothesis.

TABLE V
THE FIXATION OF IRRADIATED SET FROM HAPTIC TO VISUAL MODALITY

TYPES	Set Trials					
	1-2	3-5	6-10	11-15	16-19	20+
Hysterics $S16_1(X)$	3/16	9/16	11/16	11/16	11/16	16/16
Dysthymics $S16_2(X)$	0/16	0/16	0/16	0/16	0/16	16/16
$Sn_1(X) - Sn_2(X)$	3/16	9/16	11/16	11/16	11/16	0

1. H_0 : There is no difference between hysterics and dysthymics with regard to the number of trials that are necessary for set irradiation.
 H_1 : Hysterics will require a smaller number of trials for set irradiation.
2. Test: Kolmogorov-Smirnov two-sample test.
3. Significance level: Let $\alpha = .01$ where $N = 16$.
4. Rejection: One-tailed test; reject H_0 when $K_D \geq 9$, otherwise do not reject H_0 .
5. Decision: The largest discrepancy is 11/16 such that $K_D = 11$; this is significant at the .01 level and thus H_0 is rejected in favor of H_1 .

TABLE VI

THE EXTINCTION OF IRRADIATED SET FROM HAPTIC TO VISUAL MODALITY

TYPES	Set Trials						
	0	1-2	3-5	6-10	11-15	16-19	20+
Hysterics	5	4	0	1	2	4	0
Dysthymics	16	0	0	0	0	0	0

1. H_0 : There is no difference between hysterics and dysthymics with regard to the number of set trials needed for the extinction of irradiated set.
 H_1 : Hysterics will require a larger number of set trials for the extinction of their set.

Because the 16 dysthymics do not fixate an irradiated set(25 trials) from the haptic to the visual modality, the group cannot be tested for set extinction. Hence on logical grounds no statistical analysis is possible to test this hypothesis.

TABLE VII

SET EXCITATION IN THE HAPTIC MODALITY

TYPES	Set Trials					
	1-2	3-5	6-10	11-15	16-19	20+
Neurotics $S7_1(X)$	7/7	7/7	7/7	7/7	7/7	7/7
Stable $S7_2(X)$	6/7	7/7	7/7	7/7	7/7	7/7
$Sn_1(X) - Sn_2(X)$	1/7	0	0	0	0	0

TABLE VIII

SET EXCITATION IN THE VISUAL MODALITY

TYPES	Set Trials					
	1-2	3-5	6-10	11-15	16-19	20+
Neurotics $S7_1(X)$	0/7	0/7	1/7	2/7	2/7	7/7
Stable $S7_2(X)$	1/7	1/7	1/7	2/7	2/7	7/7
$Sn_1(X) - Sn_2(X)$	1/7	1/7	0	0	0	0

1. H_0 : There is no difference between the neurotic and the non-neurotic with regard to the number of set trials needed for the fixation of set in the haptic and the visual modalities.
 H_1 : Neurotics will require a greater number of trials for set fixation in the haptic and the visual modalities.
2. Test: Kolmogorov-Smirnov two-sample test.
3. Significance level: Let $\alpha = .01$ where $N = 7$.
4. Rejection: One-tailed test; reject H_0 when $K_D \geq 6$, otherwise do not reject H_0 .
5. Decision: In both modalities, the largest discrepancy is 1/7 such that $K_D = 1$; this is not significant at .01 nor at .05, so that H_0 is not rejected in favor of H_1 .

TABLE IX
SET EXTINCTION IN THE HAPTIC MODALITY

TYPES	Set Trials					
	1-2	3-5	6-10	11-15	16-19	20+
Neurotics $S7_1(X)$	0/7	2/7	2/7	2/7	7/7	7/7
Stable $S7_2(X)$	1/7	2/7	2/7	2/7	7/7	7/7
$Sn_1(X) - Sn_2(X)$	1/7	0	0	0	0	0

TABLE X
SET EXTINCTION IN THE VISUAL MODALITY

TYPES	Set Trials						
	0	1-2	3-5	6-10	11-15	16-19	20+
Neurotics	5	0	0	0	0	2	0
Stable	5	0	0	0	0	2	0

1. H_0 : There is no difference between neurotics and stable with regard to the number of set trials required for the extinction of set in the haptic and visual modalities.
 H_1 : Neurotics will require a greater number of trials for set extinction.
2. Test: Kolmogorov-Smirnov two-sample test (haptic modality only).
3. Significance level: Let $\alpha = .01$ where $N=7$.
4. Rejection: One-tailed test; reject H_0 when $K_D \geq 6$, otherwise do not reject H_0 .
5. Decision: In the haptic modality the largest discrepancy is 1/7 and $K_D=1$. The result is not statistically significant at the .01 level, thus H_0 is not rejected.

Since an equal number of neurotics and stable do not fixate a set in the visual modality, there is no set present to extinguish. On logical grounds, no statistical analysis is possible to test this portion of the hypothesis.

TABLE XI

SET IRRADIATION FROM THE HAPTIC MODALITY TO THE VISUAL MODALITY

TYPE	Set Trials					
	1-2	3-5	6-10	11-15	16-19	20+
Neurotics $S7_1(X)$	0/7	0/7	0/7	0/7	0/7	7/7
Stable $S7_2(X)$	0/7	0/7	0/7	0/7	0/7	7/7
$Sn_1(X) - Sn_2(X)$	0	0	0	0	0	0

1. H_0 : There is no difference between neurotics and non-neurotics with regard to the ease of irradiation of a set.
 H_1 : Neurotics will require a greater number of trials for irradiation of a set from the haptic to the visual modality.
2. Test: Kolmogorov-Smirnov two-sample test.
3. Significance level: Let $\alpha = .01$ where $N = 7$.
4. Rejection: One-tailed test; reject H_0 when $K_D \geq 6$.
5. Decision: The observed discrepancy is 0, such that $K_D = 0$; this is not significant at the .01 and therefore the H_0 is not rejected in favor of H_1 .

TABLE XII

SET EXCITATION IN THE HAPTIC MODALITY

TYPES	Set Trials					
	1-2	3-5	6-10	11-15	16-19	20+
Extraverts $S6_2(X)$	6/6	6/6	6/6	6/6	6/6	6/6
Introverts $S6_1(X)$	5/6	6/6	6/6	6/6	6/6	6/6
$Sn_1(X) - Sn_2(X)$	1/6	0	0	0	0	0

TABLE XIII

SET EXCITATION IN THE VISUAL MODALITY

TYPES	Set Trials					
	1-2	3-5	6-10	11-15	16-19	20+
Extraverts $S6_1(X)$	1/6	1/6	1/6	1/6	1/6	6/6
Introverts $S6_2(X)$	0/6	0/6	0/6	0/6	0/6	6/6
$Sn_1(X)-Sn_2(X)$	1/6	1/6	1/6	1/6	1/6	0

1. H_0 : There is no difference between the introverts and the extraverts with regard to the number of trials required for the fixation of a set in the haptic and visual modalities.
 H_1 : Extraverts will require a greater number of trials for the fixation of a set in the haptic and visual modalities.
2. Test: Kolmogorov-Smirnov two-sample test.
3. Significance level: Let $\alpha = .01$ where $N=6$.
4. Rejection: One-tailed test; reject H_0 when $K_D \geq 6$, otherwise do not reject H_0 .
5. Decision: In both modalities, the largest discrepancy is 1/6, such that $K_D = 1$; this is not significant at the .01 level, and the H_0 is not rejected in favor of H_1 .

TABLE XIV

SET EXTINCTION IN THE HAPTIC MODALITY

TYPES	Set Trials					
	1-2	3-5	6-10	11-15	16-19	20+
Extraverts $S6_1(X)$	1/6	6/6	6/6	6/6	6/6	6/6
Introverts $S6_2(X)$	5/6	6/6	6/6	6/6	6/6	6/6
$Sn_1(X)-Sn_2(X)$	4/6	0	0	0	0	0

TABLE XV
SET EXTINCTION IN THE VISUAL MODALITY

TYPE	Set Trials						
	0	1-2	3-5	6-10	11-15	16-19	20+
Extraverts	4	2	0	0	0	0	0
Introverts	6	0	0	0	0	0	0

1. H_0 : There is no difference between introverts and extraverts with regard to the number of trials required for the extinction of a set in the haptic and visual modalities.
 H_1 : Extraverts will require a greater number of set trials for the extinction of a set in both the haptic and visual modalities.
2. Test: Kolmogorov-Smirnov two-sample test(not for visual extinction).
3. Significance level: Let $\alpha = .01$ where $N=6$.
4. Rejection: One-tailed test; reject H_0 when $K_D \geq 6$, otherwise do not reject H_0 .
5. Decision: In the haptic modality, the largest discrepancy is $4/6$ and $K_D = 4$. The result is not statistically significant at the .01 level, thus H_0 is not rejected.
 Since 4 extraverts and 6 introverts do not fixate a set in the visual modality, there is no set present to extinguish. On logical grounds, no statistical analysis is possible to test this portion of the hypothesis.

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